

THE KEY INGREDIENTS

By Leith Darkin

(May 2003)

- Part 1) Gravity and human evolution**
- Part 2) Gravity and resistance training**
- Part 3) Gravity, posture and transversus abdominus**
- Part 4) What is training?**

PART 1

Gravity and human evolution

“Gravity” a very important contributing factor when it comes to life on Earth. We all know gravity exists, we’ve all heard the story of the apple that fell on Isaac Newtons head, but do we really understand or appreciate how important gravity is, how it influences everything we do and how our whole evolutionary process was shaped by gravity.

One could say that gravity is the architect of human design, it specifically designed our body so that we could co exist together. Our bones are our bodies main support structure along with transversus abdominus, this enables us to stand upright, resisting the compressive force of gravity. Our muscles connect to our bones to form a lever system, this allows us to move around freely in the presence of gravity. Our heart is designed to pump blood in an upward direction to the brain resisting gravity, while the veins in our legs have one way valves which are designed to open when our leg muscles contract then close to stop the blood flowing downwards in the direction of gravity. The way in which we consume food and pass waste products is solely reliant on gravity. The position of a fetus in relation to the birth canal and the actual birthing process is reliant on gravity. The position of a woman’s breasts, the way in which a baby suckles from its mother and the direction of milk flow are all reliant on gravity.

Another way of examining how important gravity is to human evolution is to examine what happens to humans when gravity is removed.

Studies on astronauts in space have revealed that gravity is more than a force, it is also a signal that tells the body how to act. For one thing, it tells muscles and bones how strong they must be. In zero gravity, bones loose density at the rate of 1% a month. Muscles atrophy quickly, because the body perceives it does not need them. Muscle mass can vanish at a rate as high as 5% a week. When astronauts return from long-term stints in space, they sometimes need to be carried away on stretchers as the atrophy of their muscles and loss of strength makes it too hard for them to stand upright in the presence of gravity. (Gravity hurts by Karen Miller)

Other factors of zero gravity include increased blood pressure in the brain, this results in a 22% reduction in blood volume in the first 2-3 days of zero gravity. With a reduction in blood volume the heart doesn’t have to work as hard and results in atrophy of the heart. (Dr. Victor Schneider, research medical officer for NASA).

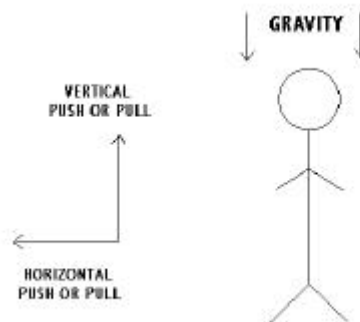
¹ Copyright Leith Darkin (May 2003)

PART 2

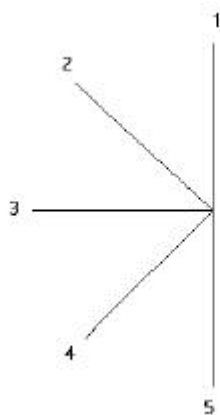
Gravity and resistance training

What is the key ingredient to resistance training? “Gravity” Without gravity you could pick up a 100-lb. dumbbell and throw it around like a tennis ball (astronauts move satellites weighing several ton with one hand). If for some reason gravity’s force was to increase then that 100-lb. dumbbell would weigh more.

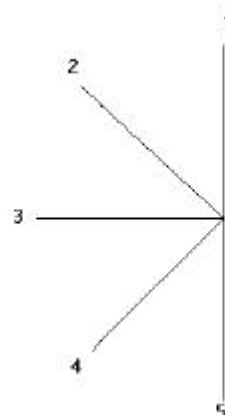
The next important consideration when it comes to resistance training is “alignment with gravity”. When standing in an upright position our alignment is perfect for an overhead push (e.g. military press) and an overhead pull (e.g. Chin up) however our alignment with gravity is incorrect for our horizontal push (bench press) and our horizontal pull (bench pull). To correct our alignment for our bench press we need to lie supine (horizontal, face up) and for our bench pull lie prone (horizontal, face down).



When looking at compound exercises for the upper body you’ll find we have our “Vertical Push & Pull”(1&5), our “Horizontal Push & Pull”(3) and our 45degree variations (2&4). Our 45degree variations amount to cross training between our vertical and horizontal joint angles. In total this gives us five “Push” and five “Pull” exercises.



PULL EXERCISES



PUSH EXERCISES

- 1) Chin up or lat pulldown
- 2) Incline lat pulldown
- 3) Bench pull
- 4) BB bent over row
- 5) Upright row

- 1) Over head press
- 2) Incline bench press
- 3) Bench press
- 4) Decline bench press
- 5) Dips

When training the upper body, your five “push” and five “Pull” exercises are the nucleus of functional strength and all other compound exercises for the upper body are variations of your five “Push” and “Pull” exercises.

When training the lower body, your functional strength exercises are.

1) The “Squat” and its variations (The “Squat” replicates standing upright to resist gravity with an external load, the path the bar travels is in line with gravity).

2) The “Deadlift” and its variations (The “Deadlift” replicates resisting gravity to stand upright while lifting an external load from ground level, the path the bar travels is in line with gravity).

3) The “Lunge” and its variations (The “Lunge” replicates resisting gravity while walking with an external load.)

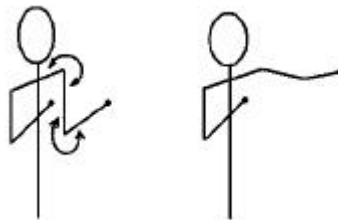
Our five “Push & Pull” exercises, our “Squat” and “Deadlift” are all performed in a stationary position, this means it is easier to keep direct alignment with gravity. Our “Walking Lunge”, “Step forward Lunge” or “Step Back Lunge” are more dynamic in nature, our hip joint provides the horizontal movement, our knee joint provides the vertical movement while our upper body stays upright aligned with gravity.

What is the difference between compound and isolation and why do we call compound movement “Functional” movement?

There are two types of motion the human body is capable of producing from our lever system.

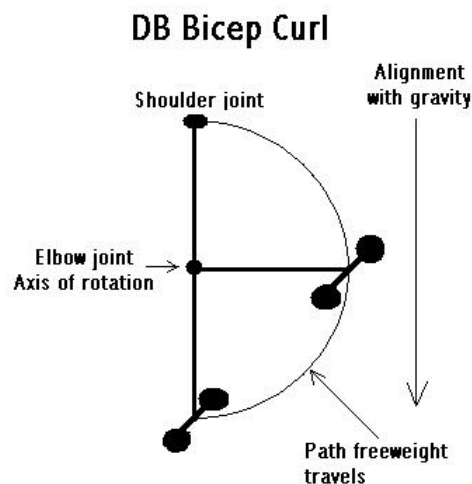
1) “Angular Motion” which is rotation around an axis. An axis in the human body can be a joint between two bones, in which case the movement around an axis is created by the pull from the muscles attached to the bones either side of the joint (The term isolation means movement at one joint).

2) “Linear motion” is motion in a straight line created by compound (multi joint) movement. When looking at the joint mechanics to produce motion in a straight line, you’ll find that the individual joint movements are actually created by angular motion (rotation around an axis), however when these individual joint movements are activated in the right sequence, you have movement in a straight line



The above picture is of an individual throwing a punch, the punch moves in a straight line (linear motion) however it is created from rotation at the shoulder and elbow joint.

We tend to call compound movement functional movement for the same reason that when we talk about functional strength we prescribe compound exercises. With compound or functional movement we have movement across several joints producing movement in a straight line. Keeping movement in a straight line is what's required for keeping alignment with gravity (e.g. our five "Push" & "Pull" exercises). With isolation exercises we have movement at one joint which means we don't keep alignment with gravity.



The above figure represents a DB Bicep Curl, you'll notice that the path the DB travels is different to the alignment with gravity. Ideally an Upright Row would be a more functional movement to raise an external load from hip to shoulder height, which would maintain alignment with gravity and in turn alleviate the sheering force gravity has placed on the elbow joint.

Compound exercises generally allows the human body to move an external load in alignment with gravity which in turn alleviates allot of the sheering force placed on the joints. Isolation exercises tend to increase the amount of sheering force that gravity places on our joints.

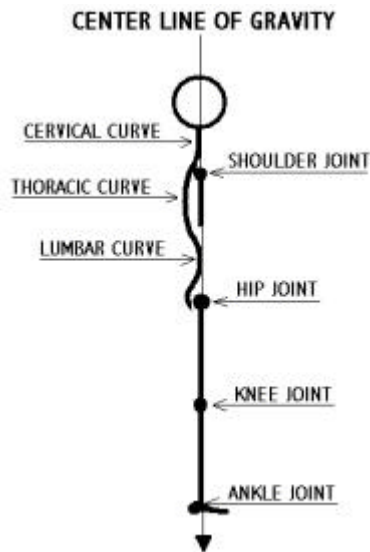
PART 3

Gravity, posture and transversus abdominus

What is the main contributing factor to poor posture? "Gravity".

You'll find that in women (especially women with larger breasts), gravity will exaggerate their thoracic curve, protract their scapulae and give them that rounded shoulder appearance. This happens because of the additional weight of their breasts protruding forwards is pulled by gravity in a downwards direction, this in turn pulls their shoulders forward, which exaggerates their thoracic curve and changes their upper body alignment with gravity.

In men it's the extra weight that accumulates around the midriff that generally leads to an exaggerated lumbar curve. Once again the additional weight protruding forwards is pulled by gravity in a downward direction, this in turn exaggerates the lumbar curve and changes their upper body alignment with gravity.



With perfect posture, the centerline of gravity runs in a downward direction through C1, through the shoulder joint, through our hip joint, through our knee joint and through our ankle joint.

Transversus Abdominus

Over recent years there's been a lot of discussion about Transversus Abdominus (TA) and the more effective ways to strengthen TA, when looking at exercise prescription for TA we need to first look at how TA works and what it is designed to do.

TA is the main support system for our trunk, it holds and supports our trunk when standing upright allowing us to resist gravity as a compressive force, it works in conjunction with our diaphragm, pelvic floor and multifidus (deep erector spinae muscle). TA wraps around our trunk, attaching either side of our spinal column with the upper portion attaching to the ribs and the lower portion attaching to the pelvis. The main function of TA is to act like a corset when it is contracted. As TA contracts, it pushes our intestines and internal organs in an upward direction against our diaphragm and in a downward direction against our pelvic floor muscles which in turn increases our inter abdominal pressure (our core area is now acting like an air shock absorber). The amount of pressure we can build up in our core area is relative to the strength of TA, the more strength the more pressure and just like our car shock absorber, the more air we pump into it, the greater the pressure, this means we can have more weight in the back of the car or more weight in the trailer.

Pilates, Swiss balls & Freeweights

Although it has been proven that Pilate floor exercises, Pilate machines and Swiss Balls are effective tools for strengthening TA, especially in dysfunctional individuals, my question is “are these forms of training the most effective way to strengthen TA?” In my opinion “no”. As humans we didn’t evolve over millions of years sitting and lying on Swiss Balls and Pilate machines. Another fault with Swiss Ball exercises, Pilate floor exercises and Pilate machine exercises used for strengthening TA, is that the majority of exercises are done in the prone or supine position, this means TA is stabilizing our trunk while resisting gravity as a sheering force to our spine. When looking at our evolutionary process, our principle of training “Specificity” would suggest that it would be more preferable to strengthen TA to resist gravity as a compressive force.

Although another important principle of training “Variety” would deem that a portion of training to strengthen TA should or could be done in the prone or supine position, the nucleus of our strength training for TA should be done standing upright, resisting gravity as a compressive force.

Some of your more effective exercises for strengthening TA are the OH Press, Upright row, BB Bent Over Row, Squat, Deadlift, Lunge, Cleans and Snatches. The key to getting the most out of these exercises with the additional benefit of strengthening TA is to beware of your posture in particular the curvature of your spine and to keep your technique immaculate.

When Looking at dysfunctional people, especially people with disc bulges who have been given the all clear by the physiotherapist to start participating in a light resistance training program with additional TA strengthening, the usual choices would be Pilate machines or sitting on Swiss Balls with light resistance. Once again I ask the question “are these options the only options open to us and are these options the better options open to us”? The above mentioned resistance training exercises used by functional people to strengthen TA aren’t going to be the preferred option as the compressive force of gravity even with light resistance could put pressure on the disc bulge and therefor aggravate the disc bulge.

A while ago I did a “Network” correspondence course by Everett Aaberg who mentioned that you could strengthen TA by standing on one leg. The rationale to this is if you are sitting on a Swiss Ball you are sitting on an unstable environment there for TA comes into to play, like wise if you are standing on one leg your body becomes unstable therefor TA must come into play. I liked the option of standing on one leg as apposed to sitting on a Swiss Ball as our evolutionary process designed TA to resist gravity so we can stand upright. I’ve personally used the method of standing on one leg with light resistance for disc bulge clients with fantastic results. I find that isolation exercises such as a DB lateral raise and the DB front raise with the arm locked straight at the elbow joint, done with light weight and higher reps to help minimize the amount of sheering force placed on the shoulder (eg.15-20 reps) to be very effective. With a DB lateral raise or a DB front raise you have the use of long lever to lift a resistance a considerable distance away from your bodies center line of gravity. This in turn challenges your body’s ability to remain balanced and not fall over, this in turn stresses TA to stabilize your trunk area. This type of training has the additional benefit of incorporating some ankle stability, knee stability and some hip stability.

⁶ Copyright Leith Darkin (May 2003)

To get the most out this type of workout you need to keep tension on your mid section (ab bracing), keep perfect posture, stay rigid through the trunk area and isolate movement to the shoulder joint only. You can also incorporate other free weight exercises with use of a shorter lever (which will be nearly as effective) such as a DB bicep curl etc. so long as you adhere to the guidelines given to you by the physiotherapist. (Remember the principle of “Individuality” not all clients are going to feel comfortable standing on one leg, in which case, sit them on a Swiss Ball or find another appropriate alternative).

PART 4

What is Training

When looking back at earths history, the firsts signs of life appeared around 1,500,000,000 years ago. The first mammals appeared around 200,000,000 years ago, the first primates appeared around 40,000,000 years ago and around 2,000,000 years ago the first humans appeared (Patrick Doncaster. The timetable of human evolution and cultural development). Over the past 1, 500,000,000 years, millions of species have come and gone, the survival of a species largely depends on its ability to adapt to changes in its environment. Nearly all species have the ability to adapt to minor changes in their environment, those that can't die, while others that are better equipped to deal with the change go onto produce offspring that are equally equipped or even more equipped to adapt to the environmental changes that have occurred (natural selection).

Humans have evolved to populate nearly every corner of the planet. They have adapted to live in the coldest regions of North Alaska to some of the hottest deserts in Central Australia to the highest altitudes of the Himalayas. Currently 17% of the worlds population live in the developed world, this means that allot of us have had to adapt to the technological revolution. This particular adaptive phase in the evolution of humans is responsible for the higher rate of inactivity, obesity and poor health in many people.

Below are examples of two different working environments and the adaptation processes involved.

EXAMPLE 1

If we look at a typical office worker that spends on average 8 hours a day sitting at a computer, 5-6 days a week, their adaptation to their environment is as follows.

- 1) Shortening of their hipflexors and hamstrings from sitting all day (these muscles are important for maintaining correct pelvic alignment).
- 2) Deterioration of other postural muscles
- 3) Atrophy of the heart muscle.
- 4) Loss of elasticity in blood vessels.
- 5) Loss of lung function.
- 6) Often overweight or obese from inactivity.

EXAMPLE 2

If we look at a laborer (eg. a brickies laborer) who spends 8 hours a day, 5-6 days a week moving bricks and mortar around their adaptation to their environment would be as follows.

- 1) Some increase in over all muscle mass.
- 2) Increase in overall strength, including core strength.
- 3) Increased lung function
- 4) Hypertrophy of the heart muscle, which will result in a greater stroke volume.
- 5) Increased elasticity of blood vessels
- 6) Less likely to be overweight or obese due to the calories expended over the working day.

Our evolutionary process and our ability to adapt allows us to adapt to these types of conditions in a relatively short amount of time. Some of the adaptations in the above two examples take effect in the matter of weeks while others will take effect over months.

Training to improve sporting performance is no different, one could say that example 1 is de-training while example 2 is training, even though the thought of de-training or training was probably the last thing on the minds of individuals when applying for these types of jobs.

The main difference between the individuals in the above two working environments and individuals specifically training to improve sporting performance, is that the individuals in example 1 and 2 put up with their working environment in the pursuit of financial gains, where the individuals in pursuit of improving athletic performance are in control of their environment and are able to manipulate their environment to bring about the biological changes needed for them to excel in their chosen sports.

Conclusion

When it comes to training we are often faced with decisions, free weights or machines? What is a more effective or appropriate exercise? Isolation or compound? Pilates? Swiss balls? Weight belts? etc .etc.

Watching documentaries on pay TV, surfing the internet, further educating my self with courses along with reading quality books and articles on Sport Science has shaped my way of thinking and given me a better understanding of our existence on this planet. This article is about how I've come to understand the environment around me and how the environment around me effects the decisions that I make.

⁸ Copyright Leith Darkin (May 2003)

References

Gravity Hurts by Karen Miller.

www.firstscience.com.

Bio Design by Everett Aaberg (correspondence course)

Australian Fitness Network.

www.fitnessnetwork.com.au

The timetable of human evolution and cultural development.

www.soton.ac.uk