

1. The foot and the body are a constant feed-forward and feed-back system.
2. In our FMR approach we have to take advantage of the forces of gravity and ground reaction.
3. Body drivers cause the foot to react in three planes of motion in all forms of function . . . we utilize the same body drivers with our FMR approach, within the same context of the desired function.
4. We must understand **Chain Reaction™** biomechanics in order to drive the foot effectively to create the appropriate **Chain Reaction™** through the rest of the body.
5. With sufficient and successful calcaneal eversion the body captures the eccentric energy creating a transformation.
6. We have less foot and ankle dorsiflexion with the subtalar joint inverted, than with the subtalar joint everted, secondary to the locking of the midtarsal joint with calcaneal inversion.
7. The key question is . . . Do you have three dimensional motion in the foot and ankle in order to effectively turn the rest of the body on?
8. *"The test is the exercise and the exercise is the test" - G. Gray*
9. Always reinforce the FMR with appropriate 3-D functional stretches along with lunges and balance reach exercises.
10. Functional range drills should be more proprioceptively challenging than our normal swing, yet consistent with the neuromusculoskeletal response of our normal swing.
11. Gary's expression of pure appreciation and thankfulness for Dave. Gary's love for Dave as a brother in the Lord.
12. Without calcaneal eversion the knee deals with an abnormal varus moment, without the ability to unload into valgus or going through the motion of abduction.
13. Lateral ankle stability requires medial loading and posterior loading gained through eversion and dorsiflexion of the foot and ankle.



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v3.4 FUNCTIONAL MANUAL REACTION (FMR)

The Foot and Ankle
By: Gary Gray, PT



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OBJECTIVES FOR FUNCTIONAL MANUAL REACTION OF THE FOOT AND ANKLE **FUNCTIONAL GUIDE**

To assimilate up-to-date information and knowledge about functional manual reaction techniques of the foot and ankle. To learn how to apply effective functional techniques when testing and training the foot and ankle.

To understand and appreciate the tri-plane **Chain Reaction** principles as they apply to the foot and ankle.

HOW TO USE THIS FUNCTIONAL GUIDE

This *functional guide* can be used as a convenient summary of the program's contents to take with you after viewing. You can also use this guide as a notebook; space has been provided so that you can make notes on relevant tracts as you watch them.



FUNCTIONAL
Video Digest Series

STRATEGY 1

Strategically appreciating that the most powerful influences in life are invisible . . . wind, gravity, our spirit.

STRATEGY 2

Strategically realizing the influence of gravity and ground reaction forces on the foot and ankle.

STRATEGY 3

Strategically understanding the influence of the 3-D capability of the foot and ankle on the rest of the body.

STRATEGY 4

Strategically analyzing the functional capabilities of the foot and ankle and its relationship to the knee, hip, and the rest of the body.

STRATEGY 5

Strategically utilizing our hands as a compliment to all the other physiological drivers in function.



STRATEGY 6

Strategically creating the motion and facilitating the stability to realize mostability.

STRATEGY 7

Strategically transforming our understanding of foot function to effective range drills.

STRATEGY 8

Strategically taking advantage of a ground up 3-D approach to training and conditioning the feet and ankles.

STRATEGY 9

Strategically gleaning pertinent information from effective functional research.



"The foot bone is connected to the ankle bone, the ankle bone is connected to the knee bone . . ."

How does the body do what it does so miraculously?

We start our biomechanical understanding of the human body from the ground up

How does the foot relate to the body and how does the body relate to the foot?

FMR . . . Functional Manual Reaction of the foot and ankle

Why does the foot do what it does?

The foot is an organ of reaction . . . it is relatively stupid

Its action is a result of its reaction

What drives the foot to do what it does?

Utilizing and directing those same drivers is the essence of FMR

The foot and the body are a constant feed-forward and feed-back system

Understanding the foot when it "hits" the ground

The driver of gravity and ground reaction force

Understanding eversion of the subtalar joint caused by gravity and ground reaction force, not by muscle action

Gravity and ground reaction force creates plantar flexion, and then dorsiflexion of the ankle

Transverse plane motion of the foot occurs in the foot and above the foot, caused by gravity and ground reaction forces

In our FMR approach we have to take advantage of the forces of gravity and ground reaction

Creating various ground reaction forces with the Biomechanical Ankle Platform System™ (BAPS) and various slant boards

The foot reacts to body drivers . . . through the **Chain Reaction™** of the body

Body drivers cause the foot to react in three planes of motion in all forms of function . . . we utilize the same body drivers with our FMR approach, within the same context of the desired function

We must understand **Chain Reaction™** biomechanics in order to drive the foot effectively to create the appropriate **Chain Reaction™** through the rest of the body



Understanding positional drivers

We take advantage of what and how the body utilizes to get it done in our FMR approach

Realizing that a foot orthosis is a form of a driver . . . it creates a functional reaction through an extrinsic force

The reason we want to make the foot function better is to make the hip and the rest of the body more functionally successful

We now call foot orthosis "butt orthosis"

The drivers that our hands compliment to facilitate pure function in the foot and ankle include:

- gravity
- ground
- motion of the body
- body drivers
- surface
- mass and momentum
- other muscle forces

Our success is determined by assessing the foot, ankle, hip, trunk and the rest of the body in all three planes of motion

The FMR question: Is the foot doing to the body what the foot needs to do to the body to make the body more successful?

The function of the foot . . . is it the primary cause, or a compensation causing another compensation and/or symptom?

Understanding the dumb-dumb talus in all three planes of motion . . . it will tell us what is going on in the rest of the foot

The locking and unlocking of the midtarsal joint

Understanding the first and fifth rays and the hallux

The ankle itself . . . primarily a sagittal plane joint with components of frontal and transverse planes as well

The foot is complex, yet dumb

Utilizing the physiological drivers along with our hands to create the appropriate **Chain Reaction™** within the context of the desired function



Happy that Dave Tiberio is here to help us

Our first FMR presentation was in reference to the hip . . . the power source of the body

How critical the motions of the foot and ankle are in order to load the hip for a successful unload

How dominant the foot is in the **Chain Reaction™**

The God-given foot motions start the **Chain Reaction™**

Functional Analysis is function specific

With walking, the foot enters into the ground hitting on the outside of the heel causing a torque, or the motion of calcaneal eversion, causing frontal plane motion up the chain, as well as transverse plane motion through the torque conversation capability of the subtalar joint

Calcaneal eversion must be assessed on everyone

With sufficient and successful calcaneal eversion the body captures the eccentric energy creating a transformation

Does the calcaneus evert at heel strike and then invert just prior to heel lift?

Start globally with a gait assessment and then go to unilateral assessment with the various body drivers

- Posterior lunge
- Posterior lunge toed out
- Posterior lunge toed in
- Posterior lunge with bilateral arm overhead reaches
- Submaximal posterior lunges
- Posterior lateral lunge
- Posterior medial lunge

- Bilateral stance with bilateral hand rotational reaches
- Bilateral stance with bilateral hand right rotational reach, creating right subtalar joint inversion and left subtalar joint eversion
- Bilateral stance with bilateral hands overhead lateral drivers
- Bilateral stance with bilateral hands overhead anterior and posterior drivers
- Left leg balance with right foot right rotation, creating left calcaneal eversion
- Left leg balance with right foot left rotation, creating right calcaneal eversion
- Left leg balance with right foot medial reach

The paradox of an everted calcaneus that can't evert anymore

The foot zooms the hip and the hip zooms the foot

Our interest in ankle dorsiflexion and the calf's ability to decelerate the lower leg



Understanding ankle dorsiflexion with subtalar eversion and with subtalar inversion

- Left leg balance with anterior nose reach as low as possible
- Left leg balance with anterior medial nose reach as low as possible
- Left leg balance with anterior lateral nose reach as low as possible

We have less foot and ankle dorsiflexion with the subtalar joint inverted, than with the subtalar joint everted, secondary to the locking of the midtarsal joint with calcaneal inversion

- Left leg balance with anterior, anterior lateral, and anterior medial nose reach at nose height
- Left leg balance with bilateral arms overhead with anterior, anterior lateral, and anterior medial nose reach at nose height

Pre-positioning for sports specific foot and ankle analysis

- Lunge analysis
- Anterior lunge
- Anterior lunge with reaches
- Lateral lunges
- Anterior medial lunge
- Posterior lunge
- Posterior lunge toed out
- Posterior lunge toed in
- Posterior lunge with bilateral arm overhead reaches
- Submaximal posterior lunges
- Posterior lateral lunge
- Posterior medial lunge

Looking for functional subtleties

- Maximal posterior lunge

Off weight bearing analysis

- callus formation
- subtalar inversion and eversion
- locking and unlocking of the midtarsal joint
- midtarsal joint inversion with subtalar joint eversion
- rear and forefoot relationships
- hallux dorsiflexion with first ray plantar flexion
- ankle dorsiflexion
- ankle dorsiflexion with calcaneal inversion and eversion

TRUESTRETCH™ Analysis

- Bias everted position
- Bias inverted position
- Bias dorsiflexed position
- Bias plantar flexed position

BAPS™ Analysis

- Analysis of distal component relative to proximal component with tri-plane motion

Do you have three dimensional motion in the foot and ankle in order to effectively turn the rest of the body on?



FMR using ground, gravity, position tweaks, end range tweaks, complimented with off weight bearing mobilizations

Going after dorsiflexion with calcaneal eversion

- Left stride stance
- Is the calcaneus everting, the ankle dorsiflexing, the tibia internally rotating, and is the knee flexing and abducting?
- Hands internally rotate the tibia distally and move the tibia forward proximally
- Hands distally drive the lateral malleolus to “lag it behind” with internal rotation

We want to see the midtarsal joint unlock, the first ray load, the arch collapse, the talus internally rotate, and the knee flex and abduct

Going after dorsiflexion with calcaneal inversion

- Right stride stance
- Get good hip extension
- Right arm, right rotational overhead reach
- Hands distally externally rotate lower leg and proximally drive tibia forward
- Drive the tibia forward over the talus distally
- Facilitate inversion of the heel
- Submaximal right anterior lunge with right arm right rotational overhead reach with manual mobilization

Going after calcaneal eversion

- Left anterior medial lunge
- Proximal hand internally rotates lower leg and distal hand everts calcaneus
- Inversion of midtarsal joint with calcaneal eversion

Going after calcaneal inversion

- Right anterior lateral lunge
- Hands drive lower leg into external rotation
- Eversion of the midtarsal joint

Off weight bearing calcaneal eversion with midtarsal joint inversion

Off weight bearing calcaneal inversion with midtarsal joint eversion

Off weight bearing first ray and hallux mobilization



TRUESTRETCH™ FMR

- Eversion tweaks
- Eversion with inversion tweaks

Transformation to homeworkable

- Demonstration of home exercises
- Self mobilizations
- Posterior lunges
- Anterior lunges with forward reaches
- Anterior lunges with left rotational reach
- Lateral lunges
- Lateral lunges with forward reach
- Lateral lunges with overhead reaches
- Lateral lunges toed in and toed out

"The test is the exercise and the exercise is the test" - G. Gray

The use of balance reach exercises

Always reinforce the FMR with appropriate 3-D functional stretches along with lunges and balance reach exercises

Take them to their functional threshold, challenge them, and keep them safe

"We got ourselves a gadget" - G. Gray

"Transform the notion into the motion . . . this is the strategy" - G. Gray

Debrief with Bob Wiersma, Executive Director, Functional Rehabilitation Network

- The importance of subtalar eversion
- Sitting, footwear, power of the butt, lack of proper training, discomfort, temporary bed rest . . . all can inhibit calcaneal eversion, internal rotation and dorsiflexion
- The body ends up cheating itself
- The body needs to capture energy in order to give energy
- It's the stored eccentric energy that allows for a concentric production of force
- The calcaneal eversion is a triggering mechanism
- Discussion of bottom up drivers
- We need to create a positive reaction (functional improvement) with our FMR approach in one treatment session or we are "barking up the wrong tree"
- The application of FMR of the foot and ankle for the elderly population
- Our FMR techniques are conducive for home carry over and home follow through
- Go where the success is . . . "What are you going to give me?"
- Work with the wisdom of the body through the butt



Gary's opportunity to work out with David "we gotta get some sweat going" functional reaction of the feet mostly from the ground up

3-D Jump Matrix™

- Anterior to posterior, left lateral to right lateral, left rotational to right rotational, anterior to posterior, right lateral to left lateral, right rotational to left rotational
- Add lateral jumps in all three planes
- Add posterior jumps in all three planes
- Add rotational jumps in all three planes

3-D Balance Matrix™

- Anterior, lateral, rotational, anterior, lateral, rotational
- Add medial hop in all three planes
- Add same side rotation hop in all three planes



3-D Hop Matrix™

- Anterior, lateral, rotational
- Add anterior hop in all three planes

3-D Jump Matrix™

- Quick feet mirror

3-D Hop Matrix™

- Quick feet with one handed face slap

Gary's expression of pure appreciation and thankfulness for Dave. Gary's love for Dave as a brother in the Lord.



Special thanks to my colleague Dr. David Tiberio for his assistance with functional transformation

The foot is a dominant part of most of our functional activities

In golf the feet are the most active parts of the body

A transformation range drill in order to get the feet more active in the golf swing

A subtle tweak from below to turn the feet on in order to effectively turn on the rest of the body

An FMR approach using bottom up and top down forces

Facilitate turning the feet and the hips on properly for an effective golf swing

Frontal Plane

Narrow base stance, with back leg lateral lunge, with backswing and explode

Sagittal Plane

Back leg anterior lunge stance, with back leg posterior lunge, with back swing and explode

Transverse Plane

Back leg anterior medial rotational lunge stance, with back leg posterior lateral rotational lunge, with back swing and explode



Frontal Plane

Wide base stance, with front leg medial lunge, with backswing and explode

Sagittal Plane

Front leg posterior lunge stance, with front leg anterior lunge, with backswing and explode

Transverse Plane

Front leg lateral rotational lunge stance, with front leg medial rotational lunge, with backswing and explode

Allow our feet to turn on more things

Functional range drills should be more proprioceptively challenging than our normal swing, yet consistent with the neuromusculoskeletal response of our normal swing



RESEARCH ROUNDTABLE WITH DR. DAVID TIBERIO

Toda Y, Tsukimura N, Kato A. The effects of different elevations of laterally wedged insoles with subtalar strapping on medial compartment knee arthritis. Arch Phys Med Rehabil 2004 85:673-677

Andrews M, Noyes FR, Hewitt TE, Andriacchi TP. Lower limb alignment and foot angle are related to stance phase knee adduction in normal subjects: a critical analysis of the reliability of gait analysis data. J Orthop Res 1996 March 14: 289-295

Understanding the link between the heel and the hip, and its effect on the knee

Changing the varus moment of the knee to a valgus moment, secondary to calcaneal eversion

Without calcaneal eversion the knee deals with an abnormal varus moment, without the ability to unload into valgus or going through the motion of abduction

An inversion moment at the subtalar joint at heel strike causes medial compartment knee arthritis

With age, we see the lack of ability to abduct the knee secondary to dysfunction of the foot and hip

We see both the chicken and the egg with dysfunctional frontal plane and transverse plane knee function



A ground up tweak, utilizing an orthosis, to facilitate effective calcaneal eversion

The difference between a valgus heel wedge and a “pitcher and a catcher” with extended forefoot lateral posting with medial heel posting

The butt and trunk need to be trained and conditioned to take advantage of what the orthosis is facilitating

The dramatic effect the foot has on the knee, hip and trunk

The effects of our FMR approach to the subtalar joints many times is dramatic and significant

Lateral ankle stability requires medial loading and posterior loading gained through eversion and dorsiflexion of the foot and ankle

With an arthritic knee, use a ground up through the foot approach to get to the foot and a top down through the hip approach to get to the hip

When helping a friend who is hurting, don't attack the friend . . . look for help in other places to comfort the friend

Our functional research continues to “strangely enough, prove function”

A special thanks to Dr. David Tiberio

