

Introduction

- One of my favorite presentations from the Functional 3 – day Summit in Chicago was Michol Dalcourt’s vector variability training presentation. In his presentation Michol Dalcourt talk’s of the relationship between our extracellular matrix (otherwise known as fascia) and training. This was a concept that was touched on a great deal throughout the three days in Chicago. I thought Michol’s presentation was the best at delivering both a comprehensive and innovative approach to understanding and training fascia. In this blog I will give you both my notes as well some thoughts and conclusions from Michol presentation.

Michol Dalcourt – Vector Variability Training – Presentation Notes

- **DEFINE THE FOLLOWING TERMS:**
 - **Fascial Architecture:** *Fascia is formed from cells (fibroblasts, mast cells, adipose cells, macrophages), fibers (collagen, reticular, elastic), ECM (ground substance, proteoglycans, Hyaluronic acid).*
 - **Mechanotransduction:** *refers to the many mechanisms by which cells convert mechanical stimulus in to chemical activity.*
 - **Extracellular Matrix:** *This is the non – living substance that surrounds the cells. ECM is synthesized and maintained by connective tissue cells (fibroblasts in fascia, osteoblasts in bone).*
 - **Pre – Stress:** *Internal stress prior to application of external force.*
 - *Mainly due to gravity*
 - *Serves to stabilize the joint*
 - *Reduces the play in our body; ensuring immediate mechanical responsiveness*
 - *Reduces the load on the structures.*
 - **Fibroblasts:** *Is a cell that synthesizes and maintains the extracellular matrix. They provide a structural framework (stroma) for many tissues. They play a critical role in wound healing.*
 - **Double Bagged theory:**
 - **Hydraulic Amplifier effect:**
- **KEY CONCEPTS**

- *Why do not rely solely on the muscular system.*
 - Human Locomotion is not just given to us via the Muscular System. Other systems are involved.
- *We are a series of tubes*
 - When pressure increase
 - When there are some hydraulic effects
 - We start to move around.
- *Muscular system doesn't stabilize as well as other systems. We should consider these systems when we train.*
- *These systems may be more efficient than the muscular system. We have other systems that are less compliant and less resistant to fatigue.*
- *Mechanotransduction is the foundation for 3 dimensional training.*
- *"The way the body is portrayed in conventional textbooks is incomplete and in many cases erroneous"*
- *When one part moves the body as a whole responds.*
- *We are an energy conduit system that captures energy. Our first job is to try to capture somewhere to make us more efficient and it is more than just the muscular system.*

Presentation

II. UNDERSTANDING THE NEW MODEL OF FASCIA

- *Old Model of Anatomy vs. The New Model of Anatomy*
 - *What is the traditional view of anatomy?*
 - "The Muscle bone concept presented in standard anatomical description gives a purely mechanical model of movement."
 - This is a statement taken from a physiology text and gives insight to the traditional view of anatomy and muscle function.
 - *What does this traditional view of anatomy tell us about muscle function?*
 - This statement separates movement into discrete functions, failing to give a picture of the seamless integration in a living body.
 - *What do we know now about anatomy and muscle function?*

- When one part of the body moves, the body as a whole responds. Dalcourt tells us that functionally, the only issue that can mediate such responsiveness in our body is connective tissue.

▪ ***What evidence does he use to support this argument?***

- Dalcourt tells us that the muscular system is not the only system that aids in locomotion. He argues that there are a lot of systems that contribute to movement in the body. He supports this argument with a study where researchers observed EMG activity during a maximal deadlift. Authors of this study indicated that during the natural lumbopelvic rhythm in the deadlift at certain point of the movement the erector spinae muscles go “quiet” showing little to no EMG activity.
 - Dalcourt uses this example to demonstrate that the body uses many resources that include muscles, bone, and fascia to complete a movement. He also states “there are lot of different systems that provide the body with stability”
- Efficiency is always the brain’s focus during movement. Efficiency demands contribution of the musculoskeletal system, as well as “pressure”. It is through this goal of efficiency that we are able to gain movement and stability.
 - Dalcourt states that from a basic fascial standpoint the body is a series of tubes that function through pressure
 - When stuff goes in to that tube with a finite amount of space pressure is created and can be mediated by many systems (i.e. muscular, facial system).

▪ ***Where does this pressure come from?***

- This pressure is caused by

- Muscular contractions
- Hydraulic effects using water
- If we understand this concept then we should understand the way we train shouldn't consider just muscles as the focus for stabilization, locomotion or movement.

▪ ***What is the current view of anatomy?***

- The body is viewed as a whole rather than separated into various parts. Each "part" of the body is seamlessly integrated from the toe to forehead.

▪ ***What evidence does Dalcourt use for our modern view of Anatomy?***

- Dalcourt shows us video footage of plantar fascia and connective tissue surrounding the calcaneus. He uses this footage to demonstrate a point: There is no such thing as distinct parts in real anatomy. We must consider the body as a whole.
 - i. In the video plantar fascia is shown covering the heel and flowing into the Achilles tendon. In the video you don't see parts you see a messy network of stuff flowing in to each other. This image highlights the concept of seamless integration within the body.

III. OUTLINE THE ARCHITECTURE OF THE FASCIAL STRUCTURE AND HOW IT ADAPTS TO FORCES

• ***Understanding Fascia Characteristics***

▪ ***What are the roles of connective tissue from a general standpoint?***

- In looking at these presentations it's important to realize that Connective tissue has some unique roles
 - It connects
 - It also disconnects

- The extra cellular matrix (ECM) is alive and responsive, it is very adaptive to the forces that are introduced to its system.
- External pressures result in more information to fibroblasts and they start growing more stuff.
- Fibroblasts contract similar to smooth muscle. Fibroblasts contract independently of skeletal muscle.
- They are slower to fatigue than skeletal muscle
- They respond to mechanical load
- They have a lower energy cost than skeletal muscle
- This extracellular matrix is also a vehicle for capturing and dissipating energy
 - i. When one part moves the body as a whole responds
- It captures energy at a low cost

○ ***What happens when we introduce load or an external stress to our body?***

- There is more than just a muscular system response.
- There is a fascial system response.
- There is also Mechanotransduction.

● ***What is the fascial architecture?***

▪ ***Fascia is made of up 3 distinct parts***

○ ***Cells***

- Which consists of
 - i. Fibroblasts
 - ii. Mast Cells
 - iii. Adipose Cells
 - iv. Macrophages

○ ***Fibers***

- Which consist of
 - i. Collagen
 - ii. Reticular
 - iii. Elastic

○ ***ECM (Matrix)***

- Ground Substance
- Proteoglycans

- Hyaluronic Acid

- ***How does fascia respond to its external environment?***

- ***What happens to fascia when we introduce and external force***

- It responds by Mechanotransduction
 - Mechanotransduction refers to a process in which mechanical force is translated in to chemical and/or cellular activity.
 - There are several examples of mechanotransduction. The most recognized is the formation of bone by osteoblasts. When there is an undue amount of load or excessive stress to areas on bone cells called osteoblasts will respond along those areas of stress by synthesizing new bone.
 - Bunion serves as a good example of this process
 - i. A bunion is nothing more than a calcium response or displacement due to the fact that it receives mechanical load or stress.

- ***What is Myositis ossificans and how does it relate to mechanotransduction?***

- If you get a nice bruise or contusion in the muscle bone will respond physiologically from this mechanical load or stress by calcifying at the area of stress. In extreme situations you can get calcification and/or bone growth in the muscle.

- ***What are the similarities between physiological responses between bone and Fascia***

- ***What is Wolf's law?***

- Bone will be built along lines of stress

- ***What is Davis Law?***

- Connective tissue is laid down along lines of stress
 - i. Dalcourt uses both statements to show that our system adapts to external forces by increasing density along these lines of stress.
- Dalcourt also uses this statement to demonstrate that Fibroblasts are like osteoblasts in bone
 - i. Instead of calcium they produce collagen. This characteristic gives them unique roles in the body.
 1. They recognize tension and instead of calcium the produce collagen along stress.

2. They play critical roles in stability
3. Fascia can contract independently of the muscle
4. They also function at low energy costs

▪ **How does this response affect areas that are not directly affected by areas of stress?**

- Dalcourt states that In relation to that line of stress every other angulation will be weaker. This statement is what I believe to be the foundation of Dalcourt's training philosophy and system. The thought is if we repeatedly apply stress to areas and those areas get stronger what about those areas that do not experience this stress. Do they become weaker? Apparently so.
 - i. Michol states that if we train our bodies along the same lines of stress those areas will be strong while all the other areas of angulations will be weaker.

- **Presentation's Principle Statement: *If I'm strong along this pattern connective tissue will be strong along this line. However, in relation to that line of stress every other angulation will be weaker.*** This concept is the foundation for vector variability training. If we want a strong balance body that is effective in all three planes of motion with gravity, ground reaction forces and the momentum we must have effective synergy between the 3-dimensional connective tissue structure in our body. To accomplish this goal we must consider angles and vectors when we train in order to prevent areas of weakness.

- **What is the relationship between training and our extracellular matrix?**

- **Real world application: Farm Boy Training vs. City Boy Training**

- To demonstrate the importance of vector variability training consider the differences between "farm boy training" and "city boy training." Individuals who grow up on a farm are raised to perform physically demanding chores that do not fall in to

specific movements. On any given day they can be asked to lug bales of hay or drag heavy machinery. These tasks result instead in a variation of movement quite different from the exercises and movements performed in a modern gym. Instead of the body part training common to conventional weight training you have movements that are instead task specific and require whole body movements to be performed efficiently. Michol Dalcourt states that farm boys are strong in many angulations making them more efficient and stronger than those who train conventionally.

▪ ***Why does Dalcourt consider farm boy training to be better than conventional weight training?***

1. Farm boy training isn't along the same angulations. Exercise and training for a farm boy takes place along at varying angulations.
 2. Farm boy chores have many different loads and are done using whole body movements.
- Farm Boy training demonstrates a need to shift away from the traditional view of anatomy and thus conventional weight training and also shows us why it is important to
- i. Vary the load
 - ii. Vary the angulations
 - iii. Vary the repetition or volume.

▪ ***What does Dalcourt consider to be ideal for fascial training?***

- If we understand how connective tissues behaves and know it to be a system that is efficient and contributes to movement than we would want to train that system. Ideally we would want to develop a connective framework that is balanced in all angulations. To achieve this balanced network it is important to develop external loads and forces in many variations.

● ***How is training influenced by the natural pressure systems within our body?***

▪ ***What is Pre – stress and what are its implications to Fascia?***

- A biomechanical term which means the internal tension of our system.

▪ ***How do we develop pre – stress?***

- The bones, the muscles, and fascia all come together to form shape stability, pre- stress or internal tension.

▪ ***What is the hydraulic amplifier effect and what are its implications to fascia and the body?***

- Hydraulic amplifier effect
 - If you had a tube around your muscles and in this tube is a finite amount of space. As you contract your muscle the pressure in this tube wrapped around your muscle also increases. This pressure in the tube translates to increase stability. The hydraulic amplifier can be described as shape and stability that arises from pressure. The tubes represent our fascial system while the pressure results from both muscle contraction and water within our body.
 - The hydraulic amplifier effect allows our body to maintain stability despite our muscles “shutting off”. Dalcourt uses this concept to explain why we can maintain stability during a maximal deadlift despite muscles shutting off.

▪ ***How does skin relate to pre – stress load?***

- What is the heaviest organ in the body
 - Answer: Skin
- What are the properties of skin
 - tensile
 - Stress strain shows curve
 - Connected to fascia
 - Has an elastic quality to it.
 - Skin helps to stabilize
 - Skin aids locomotion
 - Skin has collagen
 - i. Skin has a huge capacity to help locomotion because of its properties
 - ii. As we get older we lose the following properties for skin:
 1. That tensile system
 2. Hydration
 3. Elastic quality
 - iii. As a result we also lose our ability to move.

- ***What is the relationship between mechanotransduction, extra-cellular matrix, pre-stress and the properties of skin?***

- All of these things together work synergistically to bring about movement at low costs. These components also demonstrate that the muscular system is *not* solely responsible for movement. Dalcourt demonstrates through this presentation the importance of using whole body movement and triangulating forces to appropriately train our connective framework. By understanding the properties of fascial system we can see how these systems support the muscular system and how training this system can increase efficiency in movement.

IV. What are the keys to optimizing tissue adaptation as suggested by Michol Dalcourt?

- Evidence suggests that tissue (fascia) is better trained through a wide variety of factors. According to Michol we should focus on several guidelines when we train. The guidelines are as follows.
 - *Use whole body movements*
 - *Create optimal Environments for tissue loading*
 - *Vary forces and direction of load (triangulate exercises)*
 - *Train in intervals*
 - *Make use of environmental drivers (gravity/GRF) to create Elastic rebound.*

SUMMARY AND AFTER THOUGHTS

a. What are my immediate thoughts?

- a. In a period where we are thinking of fundamental movement patterns and how to reestablish these lost movements it's interesting to see a system that advocates movements in all angles. I think we could argue that these perspectives are built along the same line of thought.
- b. This presentation is yet another example of the shift toward a minimalist approach to weight training. The pendulum is swinging even further away from the machine based performance center to basic outdoor whole body movements. It reminds me of the Rocky IV training montage.

c. Fascia is another reason for you to focus on hydration.

b. How does his presentation affect my philosophy on training?

- After the presentation I began to question how much variation in movement is there in my training system? I found this principle of “varied angulation” to be the central point of Dalcourt’s presentation. As I review my own training system principles I notice that there isn’t a statement which specifically talks of varied angulation. The reason for this lack of statement is because I think varied angulation is implied in my own system. In my training system I always aim for balance in movements. There is always a focus on how movements are performed from bilateral to unilateral movements, quad dominant to hip Dominants, scapular depression and retraction exercises to even scapular protraction and elevation movements when needed. I incorporate sled pushing as a method of reinforcing the horizontal impulse that we place into the ground when sprinting. In addition, I am a fan of medball work as a method of challenging the body to dynamically stabilize in the sagittal, transverse and frontal plane. Even when I employ metabolic circuits in to a program there are certain movements that are unpredictable and varied in their force application. So in the end, I realize there are a wide variety of movements and angulations with various loads in my training system. This presentation serves to validate my training system.

c. Questions and Afterthoughts?

- Dalcourt mentioned that as we perform various movements repeatedly through the process of mechanotransduction we create a path or region that is stronger/ stiffer/ and more resilient than areas that do not receive the same repeated stress. This phenomenon is the result of our body’s adaptive processes that aim to protect us by providing stability in those regions. For instance the bone will lay down more minerals in regions that experience repeated stress and fascia will lay

down more connective tissue in regions that experience greater stress. While the body aims to protect us through providing more stability it can ultimately lead us to injury. Too much stability in an area can result in limited potential for motion in certain regions. This can be a significant obstruction especially for structures that are supposed to move. This idea has been covered by many individuals in the strength and condition field from strength experts to physical therapists. It's a central point in Diagnosis and Treatment by Physical therapist Shirley Sahrmann and a theme in Gray Cook's book Movement. Dalcourt approached this idea in a way that really never resonated until now. My focus has always been to discover ways in improving mobility in areas that have acquired too much stability. I've approached these presentations and resources with questions like what exercises can I design that will regain that lost range of motion. My focus has largely been methods aimed at correcting dysfunction. Dalcourt's vector variability training presents me with perspective- prevention. His presentation poses several thoughts

- Does training with a focus of creating forces at various angulations mean less stiffness in one area and greater potential for retaining appropriate mobility in other areas?
 - Is the farm Boy more mobile than the city boy because his form of training never focuses on repeating the same pattern?
- What does training with a focus on greater variation of forces mean for absolute strength? Is it a disservice to limit stress to areas that we know to experience increased load or force during competition or athletics?
 - Is the farm boy better equipped at handling completion or specific sport patterns better than those who use conventional training methods?
- How do you train like a farm boy? And how does it impact coaching?

- Doesn't that just mean less specific tasks and a greater focus on general tasks?
- How do you coach movements that are supposed to be varied?
 - i. In other words, can you coach farm boy training or is that inherently going against the benefits of farm boy training.
- Ultimately, is farm boy training better than city boy training? Why?
 - Greater proprioception through varied movement?
- If it is beneficial can you include this training within your methodology and would it be safe?
 - Dalcourt presents a training system that aims to focus on training the body as a whole in multiple angles. The result is an array of exercises with a tool he calls the viper. At first glance, the system he implements seems a bit complex. Exercises are designed based on a host of categories from the direction at which the viper is being placed to the various potential lower body movements (two feet, leg feet, later push)

In conclusion, I thought Dalcourt did a wonderful job presenting the complexities, importance and implications of incorporating fascia or connective tissue as a consideration in training. The more we incorporate whole body movements in varied angulations into our training the better we will be proprioceptively and the greater we will be able to move with strength. However, I think it's also important to realize that whole body training doesn't necessarily mean we should return to the farm and do farm chores. The reason I could never advocate my athletes to throw barrels of hay is because most of my guys would probably hurt themselves. Let's not forget the reason we broke down exercises to simple parts and regions was to make them easier to perform with less risk to the

individual performing them. I get the benefits of asking people to include more varied angles with a greater emphasis on integrating parts from head to toe, but I also realize the difficulties people experience when performing a simple movements. People in general have difficulty with just the basic tasks.