Thinking Straight (Ahead)

By Howard J. Dananberg, DPM

This will be the first article of a series that describes a medical, mechanical, and manipulative approach to management of sagittal plane malalignment. Modern podiatric biomechanics has previously centered on frontal/transverse motion evaluation since the initial signs of its development in the late 1960s. The use of rear foot posting became the most common type of orthotic therapy as it was believed that all pathology stemmed from excessive frontal plane motion at the supinatus joint. While results seemed acceptable, many found frustration with this as their only approach, and many patients did not respond to this type of treatment. By combining with the Vasyli family of companies, a new procedure (Vasyli-Dananberg) will be developed that will add the tool of sagittal plane treatment to the orthotic therapy management.

When a subject stands forward, a complex series of linked motions occur in sequence, creating what we have come to understand as normal foot function in classic podiatric fashion from the rear view (ie, railway perspective), the dynamics of the motions are subject to be appreciated. Alteration of the position of the leg, however, will result in a knee that is not simply perpendicular but actually a combination of hip extension and knee flexion. For instance, the combination of reduced hip extension with simultaneous flexion of the knee is simply not perceptible. However, once the observer stops at a point of view which side motion becomes visible, then suddenly a new world opens to the kinetic process of human walking. When one only considers the rear view, the combined amount of foot level motion of inversion/eversion and internal/external rotation is well over 20°. However, considering the normal range of motion of 65° of the metatarsophalangeal joints, the magnitude of sagittal plane motion starts to be evident. When the sagittal axis is a central axis of the heel and ankle joint, coupled with extension mechanics of the hip, the mechanics of the sagittal plane becomes a dynamic increase as compared to only the frontal-plane (and transverse in perspective). Not viewing the sagittal plane is akin to ignoring its presence. Failure of normal sagittal plane axial motion to occur in a timely fashion would require force disaspiration through the remaining planes. What we have traditionally called "excessive stance position" or "late phase pronation" is the REPRESENTATION of the foot's dispersion of these forces through the transverse and frontal plane. Treatment outcomes improve substantially when the bulk of the motion is included in the evaluation and addressed in the treatment process.

Sagittal plane restriction

When we step forward, the mechanical action of the swing limb actually pulls the body. The lifting limb, therefore acts upon the weight-bearing or trailing limb. For normal motion to occur, the hip and knee move towards extension, while the foot permits sagittal/based rotation to occur. This allows for the force to remain in the eccentric plane, so that the limb is driven naturally and passively extends out from under the hip joint. Should failure of any of the sites of sagittal plane motion occur then a series of compensatory motions would be required. The primary locations for sagittal plane restriction are as follows:

1. Functional hallux limitus (FHL)
2. Structural hallux limitus (SHL)
3. Ankle equinus (AE)
4. Forefoot Equinus (FE)
5. Hip joint arthritis
6. Forefoot pain/midfoot pain

1. Functional hallux limitus: Functional hallux limitus is a strictly condition in which normal motion exists at the 1st metatarsophalangeal (MTP) joint during non-weight bearing examination. When loaded and distinctly during the single support phase of the gait cycle, however, no range of motion is available. This paradox is what defines FHL. There is often no pain associated with the MTP joint at all, since when the opposite foot is flat on the support surface, since the body continues to move about pain as the foot and more proximal structures are repeatedly stressed during the compensatory process. Since pain is a typical sign of a functional disorder, the use of orthotic modifications are required for management. This is a very basic principle around the Vasyli-Dananberg device. By using a variety of removable plugs on the inferior surface of the 1st metatarsal head, varying degrees of present during foot function. Ankle equinus was probably the first entity to be both observed and described causing the fibula and talus can restore motion to the foot, which can also occur and will be described, along with recommendations for a large variety of compensatory modifications and ankle related to the equinus state.

2. Structural hallux limitus: Structural hallux limitus or SHL represents the degenerative joint process involving the 1st MTP joint. Motion can be partially or completely halted (rigid positioning) restricted. Classic treatment of SHL involved the reduction of motion at the 1st MTP joint, with the basic reasoning that “it hurts to move, so let’s prevent the motion”. To think about SHL is another way, however, it opens up a larger area to full treatment of the pain and function. In this sense, the foot is treated as a unit, and thus reverse (partial or completely) the degenerative joint process. One thinks of SHL as hurting “because it doesn’t move when it should”. In other words, SHL is a RESULT of the repetitive strain applied to the 1st MTP joint because the prosector to SHL is FHL. So the joint fails to move at the time when maximum motion is required. Jarring of the joint results with eventual structural changes developing as the body repeatedly tries to repair the chronically injured site. Use of the Vasyli-Dananberg device is one part of the degenerative process, and the addition of other manual therapies can enhance this effect. These will be covered in future articles.

3. Ankle equinus

Ankle Dorsoflexion

Ankle Dorsiflexion = 20°

Functional Ankle Limitus: Functional ankle limitus or FHL is a strictly condition in which normal motion exists at the 1st metatarsophalangeal (MTP) joint during non-weight bearing examination. When loaded and distinctly during the single support phase of the gait cycle, however, no range of motion is available. This paradox is what defines FHL. There is often no pain associated with the MTP joint at all, since when the opposite foot is flat on the support surface, since the body continues to move about pain as the foot and more proximal structures are repeatedly stressed during the compensatory process. Since pain is a typical sign of a functional disorder, the use of orthotic modifications are required for management. This is a very basic principle around the Vasyli-Dananberg device. By using a variety of removable plugs on the inferior surface of the 1st metatarsal head, varying degrees of present during foot function. Ankle equinus was probably the first entity to be both observed and described causing the fibula and talus can restore motion to the foot, which can also occur and will be described, along with recommendations for a large variety of compensatory modifications and ankle related to the equinus state.

4. Forefoot equinus: Forefoot equinus is another way to view the deformity associated with calves foot. In a forefoot equinus situation, the level of the metatarsal heads is essentially lower than that of the distal end of the first metatarsal. This dorsiflexion moment is to be applied to the ankle joint, as the forefoot loads during the gait cycle. A forefoot equinus problem is to think of it as making the body walk "uphill" all the time. Elevation of the heel is the most straightforward approach to management.

5. Hip joint arthritis

Degenerative disease of the hip is a common orthopedic problem. Some stress reduction via foot orthotic management may be helpful, but only arthritis of the hip may ultimately require surgical management. Patients who are unable to extend their hips during the normal gait cycle can be helped if lack of motion is shown to be directly to some type of compensatory process.

6. Forefoot or midfoot pain

Chronic pain in the forefoot (including corns and callosities) or pain in the midfoot due to degenerative joint disease prevents normal footed leading and the ability to raise the heel about the forefoot pivot. Careful diagnosis of the problem are required to manage this type of patient, and surgery may be necessary to deal with the long term outcome. Certain types of midfoot pain are related to restriction in joint mobility, and manipulation mobilization can often be extraordinarily successful. These techniques will be described in detail both in future articles as well as on the Vasyli website in future web based lecture programs.

In conclusion, one or multiple entities can exist that alter the ability of the body to step over the foot during the single support phase of the gait cycle. These in turn create compensations within the foot and more proximal structures that create or perpetuate many painful pathological conditions ranging from planter fasciitis to knee pain in chronic lower back pain. Localized treatments can be very effective, but relieving the repetitive strain present during the gait cycle is what prevents recurrence. The purpose of this series is to detail how these compensations occur and what are the best available methods of treatment.

REFERENCES:

www.vasyli.com/medical