Reverse Mortons Extension

Cluffy Wedge® versus the Reverse Mortons Extension for improving first ray function

Improving first ray function is an important benefit of an orthotic or insole. The reasons for this are as follow:

1. Improving motion of the first MTPJ will improve foot stability in propulsion, and allows the foot to assume a close-packed position. This occurs through activation of the windlass mechanism.\(^1,6,7\) (Fig.1)

2. By allowing the first MTPJ to bend normally, compensatory gait patterns are minimized, reducing symptoms in the foot and supra-structural areas.\(^2,3,5\)

3. It enhances the ability of the foot to supinate in propulsion and externally rotate the lower limb, providing for postural improvements.\(^1,6,7,8\) (Fig. 2)

With orthotic and insole corrections, we are trying to control rear-foot motion, and support the midtarsal joint. We must also address first ray function. This is a critical element of normal foot function. So the orthotic or insole must work in all three phases of gait to provide optimal benefits to the user.

The reverse mortons extension (RME) (Fig. 3) has been popularized as a method of improving first ray function despite the fact that there is no known research on the effects of the most popular RME, the flat piece of firm material that goes under metatarsals 2-5 and leaves a cutout for the first metatarsal. This effectively minimizes ground reaction force on the first metatarsal head.

Forefoot valgus wedges (RME wedged laterally) have been studied and have been shown to provide a pronatory force to the rear-foot.\(^9,10\) This is consistent with the subtalar joint axis theory of rotational equilibrium as proposed by Dr. Kevin Kirby.\(^11\) (Fig. 4) That is, the correction is applied lateral to the STJ axis and provides a pronatory force to the foot in most cases unless the STJ axis is laterally deviated as in a metatarsus adductus foot type, a clubfoot and some cavo-varus feet. As the FF valgus wedge height is increased the pronatory force to the rear-foot increases.\(^9,10\)
By decreasing ground reactive force under the first metatarsal head, it is felt that the first metatarsal can plantar flex into the ground easily, to facilitate normal motion of the first MTPJ. Providing a slight overload to the second MTPJ is felt to be necessary to facilitate the off-loading of the first MTPJ.

While the benefits of potential improvement in ROM of the first MTPJ may happen with this approach (although this has not been validated) there are several potential downfalls of this approach that I would like to point out.

1. Lesser metatarsal pressures will most likely be accentuated by adding material under the lesser MTPJ’s. Lesser metatarsalgia is often a presenting symptom of first ray insufficiency and this effect is counter-intuitive and a clearly adverse effect when addressing this complaint.

2. First metatarsal head pressure will only be accentuated if the foot pronates, this includes rear-foot pronation in a valgus wedge study. A first ray cutout will decrease metatarsal head pressures unless the foot pronates and rolls medially into the floor. Active propulsions is when the foot should be supinating, so this will create excessive internal rotation of the leg at a time when it should be externally rotating.

3. The medial leg of the supportive tripod of the foot will move lateral, again causing the foot to fall to the inside or pronate, an adverse effect in active propulsion. (Fig.5)

4. RMEs are time consuming to apply to OTC after market insoles and can be difficult to remove.

5. RME add to the bulk of the device on the ball of the foot. This may make fit in some shoes challenging.

The Cluffy Wedge® pre-stresses the hallux in dorsiflexion. (Fig. 6) Research conducted at Temple University School of Podiatric Medicine has shown improvement of first MTPJ dorsiflexion of statistical significance, when combined with medial longitudinal arch support. First metatarsal head pressures were increased and all lesser metatarsal head pressures were decreased. (See research poster exhibit at cluffynstitute.com) Other research currently being conducted is showing statistically significant improvement in mean and maximal pressures of the first metatarsal. The following benefits can be realized with the Cluffy Wedge®

1. It overcomes functional jamming of the first MTPJ, which is felt to be a primary cause of first ray insufficiency. (Fig. 7) First MTPJ dorsiflexion results in plantar declination of the first metatarsal head and improvement in pressures under the first metatarsal, this will tend to reduce pressures on the lateral metatarsals. (Figs. 8 & 9) Ground reaction force is immediately transmitted to the floor, which initiates rear-foot supination and external limb rotation, a key component of addressing postural problems. See this video link: http://www.youtube.com/profile?user=cluff ybiomedical#p/u/11/MxK5YH9Sy1M

2. It allows the body to roll over the first MTPJ, minimizing compensatory supra-structural compensations and does not sacrifice first metatarsal head weight bearing, which will reverse rear-foot pronation and initiate external leg rotation in active propulsion.

3. Is easily applied and removed if necessary and does not add bulk to the ball of the foot. It does not work in narrow toe box dress shoes where there is limited space for the toes.

**CONCLUSION:**

When considering the available research, the CW offers a better solution to first ray insufficiency without introducing probable disadvantages to normal gait. Flat RME’s have not been reviewed in the literature. Forefoot valgus wedges have shown pronatory effects on the rear-foot. Care needs to be taken, given these observations on the foot type these are being recommended for. Kinematic data is not available on the RME. Basic principles of foot function and Newtonian physics would cast some doubt on the deleterious effects this may have on body posture and supra-structural mechanics. Preliminary research data is showing the CW to be the superior choice for controlling first ray function. First ray function is very important to address with an orthotic and should be addressed as of equal importance to rear-foot control and midfoot support as the windlass mechanism is an extremely reliable tool for stabilizing the midfoot by bringing the foot into a stable
close-packed position with hallux dorsiflexion. In addition, normal rear-foot supination is initiated with increased weight bearing of the first metatarsal head. The implications of this are large given the sheer magnitude of posture related ankle, knee, hip and low back problems, given the endemic prevalence of functional hallux limitus.

References:

10. Souza, TR. ET al. Late rear-foot eversion and lower limb internal rotation caused by changes in the interaction between forefoot and support surface. JAPMA, 99,6, 2009.
12. Poster exhibit at ACFAS meeting, 2010. Available at the following link:
13. Personal communication with Don Kowalsky at Quinnipiac University.