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Don't get caught flat footed — How over-pronation may just be a dysfunctional model

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Abstract For many years there has been a long-held clinical belief that a flat or over-pronating foot should be supported; yet in every other part of the body it has long been recognised that use of support (if at all) should generally be limited to acute rehabilitation. Why should the foot be any different? To support a biological structure, in the long term, is to weaken it. Panjabi's model of joint stability offers insight into why the idea of arch support, as well-intentioned as it may have been, may be a dysfunctional model. A test (and conditioning exercise) is presented which appears to support the notion that there is no such thing as a flat foot; only a de-conditioned foot.

Over-pronation, flat feet, pes planus, fallen arches ... a topic of some controversy among the bodywork and movement community, and a brief review of the literature may offer some insight as to why this is so. With reported incidence levels ranging from less than 1% to as much as 78%, the means of defining a foot as "flat" has poor agreement (Evans and Rome, 2011). In addition to this, whether or not the static flat foot in standing posture is actually related to over-pronation in dynamic or loaded movement, such as gait, is also debated (Buldt et al., 2013). And, beyond this, whether an over-pronating foot is associated with increased injury risk is also contentious. Either way, from a sports performance point of view, over-pronation is motion (or energy lost) into the frontal plane, of magnitude greater than is required for efficient forward propulsion. And this is before you introduce the possibility of orthotics, motion control, multibillion dollar sports-shoe industry marketing and so on (Robbins and Hanna, 1987). For example, according to McDougall (2009) Nike presented research at a conference as far back as 1986 that showed jumping onto a cushioned surface actually increased ground impact forces compared to landing on a hard non-cushioned surface barefoot, this was corroborated by Robbins and Waked (1997). Richards (2008) also published a review of the literature confirming that the sports shoe industry was not evidence-based, and challenged sports shoe manufacturers to provide evidence, which was met with silence.

There is also the question of degree. How much "flat footedness" is a potential problem or should be regarded as relevant by the bodyworker or movement therapist — and how can it be measured simply, but effectively?

The credit card test

One test that is able to simply measure the degree of subtalar pronation is the credit card (or business card) test

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Figure 1 **Standing Credit Card Test**: This test is designed to screen for subtalar joint neutral. Podiatrist, Michel Joubert, found that clinically when the talus is palpated to be in subtalar neutral this equates with the lateral malleolus being in direct vertical alignment above the lateral border of the foot. For those with inexperience in palpation, the credit card is an efficient and objective test for static subtalar pronation — inasmuch as the distance from lateral malleolus to vertical border of the credit card/business card can be measured in millimetres.

developed by podiatrist, Michel Joubert. With the patient in easy normal standing (it is often useful to ask the patient to march on the spot and let their feet fall into a natural stance, before they are assessed), place a credit card alongside the lateral border of the foot in alignment the lateral malleolus (see Figure 1).

The result should be that the lateral border of the foot is in direct alignment with the lateral malleolus. If the malleolus has moved medially, it is an indication of static hindfoot (or subtalar) pronation. The degree of static pronation can be measured simply by the distance between the vertical border of the credit card and the lateral malleolus — usually ranging from between a 5—15 mm.

Using this test, experience suggests that within patient and student populations, over-pronation is much closer to, and possibly greater than, the 78% prevalence described above. Of course, there are also those with a neutral foot, those with high-arches, over-supination (or "under-pronation") and pes cavus, but could these be a symptom of something altogether bigger?

Moving into the 21st century

A prevalent view of the foot and its role in whole-body biomechanics in the 20th Century was one in which the foot was the foundation and any anomaly would have a knock-on effect up the kinetic chain (Korr, 1969), and any collapse or weakness should be supported extrinsically using a passive device; an orthotic. This would appear to make good sense at initial glance, much like addressing the foundations under the Leaning Tower of Pisa; although any structural engineer would instantly raise their eyebrows at placing a support under the keystone of an arch.

Figure 2 **Foam Roller Longitudinal Single Leg Exercise**: Here the patient is laying supine on a foam roller, with only one foot touching the ground (pictured). The foam roller has been used clinically for many years, for self-mobilisation and myofascial release. Its role in stimulating balance has also been explored. In this exercise the patient lays supine, arms across chest and lifts one foot from the ground. Almost invariably the foot remaining in contact with the ground will immediately and pro-actively neutralize its subtalar position and regain a full arch.

Nevertheless, with the budding understanding of motor control at the end of the 20th Century, a more 21st Century view has arisen; the recognition that anomalies at the foot, especially in terms of loading response, are largely controlled in a descending pattern from the core and the hip downwards. A quick look at the cross-sectional area and power generation capabilities of the musculature of the foot, versus the hip or trunk, helps to highlight this. When it is understood that to simply jump off one leg creates loads at the foot—ground interface of around 9 times bodyweight (Foster et al. 1989), it is clear that muscles with cross-sectional areas of just millimetres could not effectively resist or transfer such loads. Instead, a *tensegral* myofascial net, extending from the core down through the major hip rotators (which include the uniquely human and strongest, most phasic musculature in the human body) through the leg and into the foot is the most plausible view of how the foot can transfer such loads, given our current knowledge base. This view is unsurprisingly corroborated by study of ontogenic motor development (what prepares the individual for bipedal gait) and the evolution of vertebrate design (what prepared the species for bipedal gait) (Radinski, 1989).