



The ToePro Dynamometer™ signals a change to the way we approach diabetic foot disease.

Makes clinical assessment of Diabetic foot weakness easy



The ToePro Dynamometer™

Boston, September, 12, 2018 - The way in which we assess diabetic feet in a clinical setting could change dramatically with the advent of a new device to assess muscle strength in diabetes.

Foot muscle weakness can develop very early in diabetes and occurs often well before sensory changes are detected in the foot. (Andersen, Gjerstad and Jakobsen, 2004; Greenman et al., 2005) It is one of several factors which can lead to structural changes in the toes – specifically clawing and hammering of the toes. Muscle weakness increases further with the onset of peripheral neuropathy that often develops later in diabetes. The atrophy of small foot muscles worsens muscle imbalances in the feet and with retraction of the

toes often results in prominent metatarsal heads, toe deformity and, in combination with connective tissue thickening, limited foot joint mobility. These changes are strong predictors of increased plantar forefoot pressures and together are the number one predictor of peak forefoot pressures, essentially crushing tissues under the forefoot, a major risk factor in diabetic ulcer formation (Pham et al., 2000).

The ToePro Dynamometer™ is the first low cost and easily available instrument to assist in the measurement of foot strength in all people, including those with diabetes. The instrument evolved from the research of Professor Hylton Menz at La Trobe University in 2006 who sought to identify a simple method of measuring foot strength in a clinical setting using the age-old Paper



Dr Thomas Michaud, inventor of the ToePro Dynamometer.

Grip test (Menz et al 2006). Leading author and respected biomechanics expert Dr Thomas Michaud adapted this technique to create the ToePro Dynamometer™.

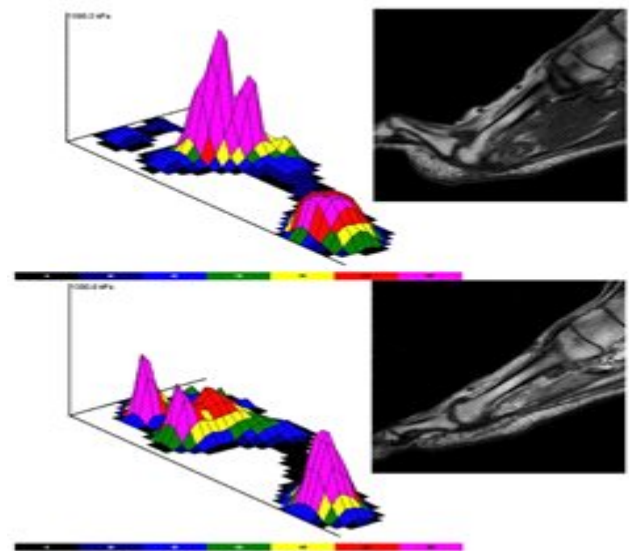
Toe grip strength has been shown to detect foot muscle weakness and can predict the risk of falls (Menz, Morris and Lord, 2006; Mickle et al., 2009), reduced athletic performance (Kulmala et al., 2014; Paquette, Devita and Williams, 2018), clawing of the toes (Mickle et al., 2009), and has been implicated in heel (Sullivan et al., 2015) and knee pain (Uritani et al., 2017) amongst other conditions. Identifying weakness and measuring response to physical therapy objectively has been difficult in a clinical setting. The ToePro Dynamometer™ gives practitioners the opportunity to solve this problem and measure physical therapy interventions for a variety of conditions in both diabetes and in a wide variety of other ailments of the lower limb.

The ToePro Dynamometer™ can be used quickly and simply to create reliable, reproducible tests of foot strength and can be used as part of a standard diabetic foot assessment. With the identification of foot weakness, practitioners can implement foot strength and mobilisation programs to assist in reversing the loss of strength and maintaining

mobility of the forefoot in people with diabetes (Balducci et al., 2006; Sartor et al., 2014; Kanchanasamut and Pensri, 2017). With this intervention we can help prevent the progression to foot ulceration that is so common in diabetes.

Further background

We have known for over a decade that the structural changes that predispose to diabetic ulceration occur long before both sensory and vascular changes in the foot and are probably greater predictors of future ulceration (Mueller et al., 2003). Largely this has been ignored because practitioners are often pre-occupied with the later



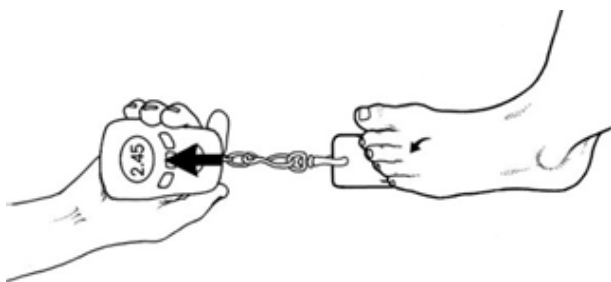
classical sensory and vascular changes of diabetes. A wait and see approach to diabetic foot care has been the mainstay of podiatric care. A lack of research around preventing structural changes in diabetes has also stymied a change in culture to act earlier on in the disease to slow or prevent structural problems.

With ageing, most people will experience roughly a 50% loss of muscle fibres between 50 and 80 (Campbell, McComas and Petito, 1973; Nair, 2005).



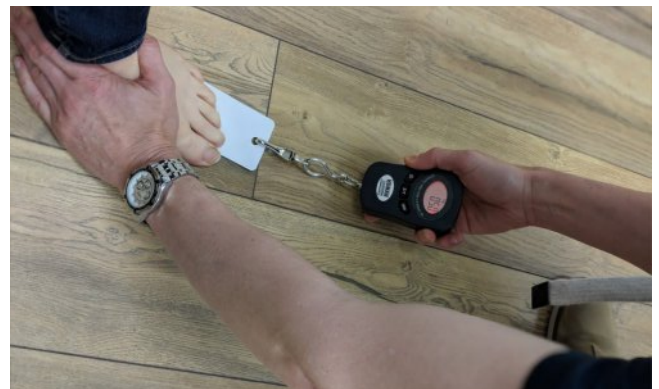
It has been shown that this muscle atrophy occurs primarily distal to proximal therefore involving the small muscles of the feet first (Kulmala et al., 2014). When combined with diabetes this wasting process has been shown to be amplified even further. This is worse again when combined with a sedentary lifestyle (Park et al 2009).

Because Insulin is a significant anabolic hormone integral to muscle growth, muscle atrophy is one of the first signs (weight loss) of Type 1 diabetes. In Type 2 diabetes, insulin resistance also contributes to muscle atrophy. In undiagnosed Type 2 diabetes the muscle atrophy that occurs prior to diagnosis has been shown to be even more remarkable (Park et al 2009).



There is an under appreciation of the early physical changes that take place in the development of diabetic foot disease which are then worsened once sensory and vascular manifestations occur. It is often not until patients exhibits pressure calluses, or sensory and vascular changes are detected that practitioners begin to implement foot health strategies. Waiting for these later changes misses

an opportunity to maintain the health of the foot earlier in the disease. However, with the use of strengthening, stretching and mobilisation of foot joints we now know that we can reverse some of these changes, even in the late stage of the disease. These interventions are more likely to be effective if they occur earlier in the disease process, before irreversible fixed deformities have occurred (Höhne et al., 2012; Sartor et al., 2014; Kanchanasamut and Pensri, 2017).



Conclusion

It is time that we diverted our attention to earlier intervention in diabetes to better manage the structural manifestations of the disease in the foot. Given the now known importance of these changes it is likely that if we can limit their development we can indeed make substantial changes to the course of foot disease and patient morbidity.

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