TOE PLANTARFLEXION EXERCISE FOR METATARSALGIA

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My disclosure is in the Final AOFAS Mobile App.
I have no potential conflicts with this presentation.
BACKGROUND

- Toe plantarflexion weakness has been suggested to be associated with forefoot deformities and disorders.
  Endo M: J Gerontol. 2002

- Common conditions that will cause forefoot pain is metatarsalgia.

- Relationship between toe plantarflexion weakness and metatarsalgia is poorly understood.
- There are no validated measures for assessing toe weakness in the clinical setting.
OBJECTIVE

we developed a new device that measures toe plantarflexion strength as strength to press the floor.

The aim of this study was to assess the hypothesis that toe plantarflexion exercise can affect metatarsalgia.
Patients
20 patients (17 women and 3 men) were enrolled. To be included in this study, the patients had to present a characteristic history of metatarsalgia continuously for at least 2 months.

Method
Clinical trial with a 8-week toe plantarflexor muscle exercise training program. Before and after training program, toe plantarflexion strength was measured using push-type toe grip strength meter in both upright and sitting position. Every patient was measured both feet twice on the same day.

Reliability of the device was assessed with Brand-Altman plot using the intraclass correlation coefficient (ICC)
Patients were assessed using the visual analogue scale (VAS), the American Orthopaedic Foot and Ankle Society (AOFAS) scoring system, number of marble pickup with toes.

The Wilcoxon signed-rank test was used to compare the outcomes.
RESULTS

The ICC of the device was excellent (0.88~0.96).

The mean age was 61 (45-78). 6 patients had bilateral and 14 patients had unilateral metatarsalgia. In the unilateral cohort, toe plantarflexion strength of the symptomatic foot was weaker (P<0.05) than asymptomatic foot in upright position (47.1N and 71.0N).

After 2 months training program, toe plantarflexion strength was significantly increased both upright and sitting position (p=.01 and p=.03).
The mean VAS score decreased from 5.2 to 2.5 (p = .00), AOFAS score improved from 67.2 to 77.1 (p = .00), number of marble pickup with toes also improved from 7.7 to 9.5 (p = .00).

No adverse events were reported.
DISCUSSION

During the toe off of the gait cycle, only the forefoot is in contact with the ground

- active and passive components of toe plantarflexion have significant effect on the load distribution across the forefoot at toe-off stance.  
  
Hamel et al., 2001

Weakening toe plantarflexion interrupts the physiologic weight-bearing mechanism between metatarsal heads and toes. This pathologic conditions produce metatarsalgia.

Our study indicates gaining the toe plantarflexion strength will provides physiologic balance between metatarsal heads and toes.
DISCUSSION

An advantage of the push-type toe grip strength meter is that toe flexor muscle strength is measured as strength of weight-bearing. The toe flexor muscle strength decreased with age result in loss of balance during gait. This device can be applied to the prevention of falls in elderly individuals.

Limitations of this study
- Relatively small sample size, furthermore, gender distribution is skewed, with few men (15%).
- A clear cut-off strength value was not identified.

Future studies will focus on the establishment of normal values in a large population.
The toe strength exercise program can be one of the means to treat metatarsalgia in addition to insole and metatarsal osteotomies.

The push-type toe grip strength meter provides an accurate clinical assessment of the toe flexor muscle strength.
REFERENCES