

Comparison of shear wave elastography between normal plantar fascia and plantar fibroma

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Background: Plantar fibromatosis is an uncommon, benign, and hyperproliferative fibrous tissue disease characterized by localized nodule within the plantar fascia. On conventional B-mode ultrasonography, fusiform nodular thickening of the plantar fascia in the midfoot or forefoot region is typical finding of plantar fibromatosis, while plantar fascia thickening (≥ 4 mm) at or near the calcaneal insertion is the most important diagnostic parameter for plantar fasciitis. Recently, a few retrospective studies have reported softening of plantar fascia on ultrasound (US) elastography in patients with plantar fasciitis. However, there are no study on tissue elasticity of the plantar fibroma. The aim of this study was to compare the tissue elasticity between plantar fibroma and normal plantar fascia using shear wave elastography (SWE).

Method: In this prospective study, 7 patients (10 feet) with the clinical diagnosis of plantar fibromatosis and 4 young healthy subjects (8 feet) were recruited. The clinical diagnosis of plantar fibromatosis was established based on history-taking and physical examination. The inclusion criteria were as follows: (1) ≥ 19 years of age, (2) palpatory painful, firm and fixed subcutaneous nodule in foot sole, (3) fusiform thickening of plantar fascia on ultrasonography. The subject with following criteria were excluded: (1) systemic inflammatory disease, (2) history of fractures or surgery in the foot, (3) history of injection in plantar fascia within 3 months. B-mode sonography and SWE were performed using an RS85 US system (Samsung Medison, Seoul, Korea). The

SWE-information was acquired quantitatively as Young's modulus (kPa). SWE of plantar fibroma was measured in the long-axis view by placing a region of interest (ROI) of 1-mm-diameter in the most rigid part of the fibroma (Figure 1-A). SWE of normal plantar fascia was measured in the long axis view at total 6 region of the midfoot and forefoot area and the mean value was acquired (Figure 1-B, C). The clinical symptoms was evaluated by Numeric Rating Scale (NRS) and Foot Functional Index (FFI) for pain and function scale.

Results: There was significant difference between two groups in baseline characteristic including age and sex, but there was no significant difference between the two groups in BMI (Table 1). SWE parameter (kPa) of plantar fibroma was significantly higher than that of normal plantar fascia ($p = 0.02$). The mean thickness of plantar fibroma was 3.33mm (SD ± 1.01). There were no significant correlation between FFI and SWE (Spearman's $\rho = -1.10$; $p = 0.80$) and between NRS and SWE (Spearman's $\rho = 0.37$; $p = 0.42$) in patients with plantar fibromatosis.

Conclusion: The result of our study suggests that the tissue elasticity of plantar fibroma appears to be greater than normal plantar fascia regardless of clinical symptoms of patients with plantar fibromatosis.

Table 1. Baseline demographics of subjects

	Normal (n=8)	Plantar fibroma (n=10)	p-value
Age	30.00 (±1.31)	49.00 (±15.36)	0.004 [†]
Male (%)	8 (100%)	5 (50%)	0.036 [‡]
BMI (kg/m ²)	24.54 (±2.87)	23.69 (±2.01)	0.468 [*]
Symptom duration (week)		39.20 (±29.86)	

Datas are presented as mean (±SD).

P-values for between group difference by ^{*}chi-square test or [†]Mann-Whitney test in continuous variables or by [‡] χ^2 test in categorical variables.

Table 2. Comparison of elastographic parameter between plantar fibroma and normal plantar fascia

	Normal plantar fascia	Plantar fibroma	<i>p-value</i>
SWE (kPa)	72.39 (±23.87)	122.55 (±51.41)	0.02

Datas are presented as mean (±SD)

P-value for between group difference by Student's t-test

SWE, Shear Wave elastography; SD, Standard deviation

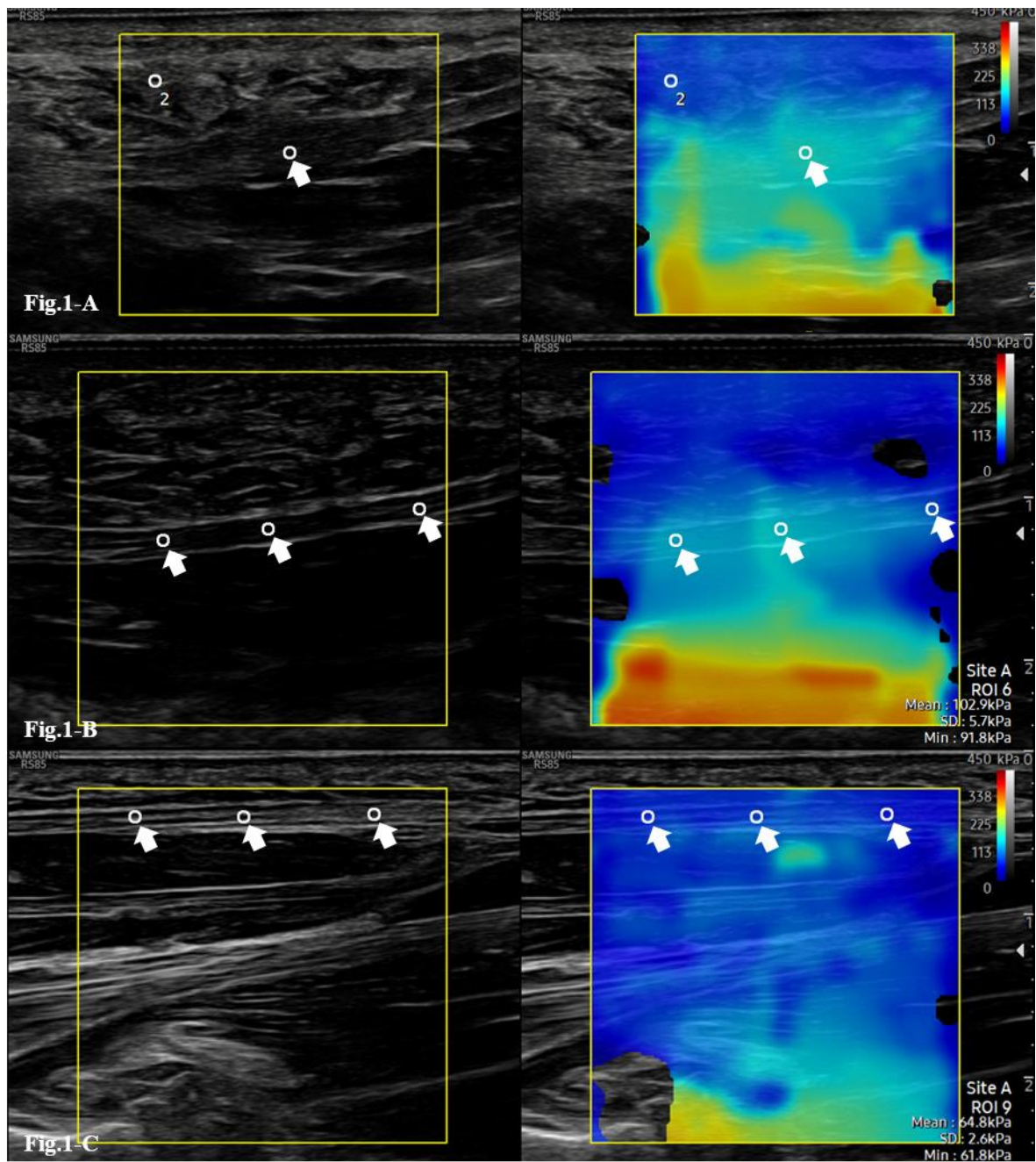


Fig. 1-A Plantar fibroma. Fig. 1-B Plantar fascia of midfoot. Fig. 1-C Plantar fascia of forefoot.
Bold arrow, site of shear wave elastography (SWE) measurement.