

## Autologous fat grafting for plantar fat-pad atrophy in systemic sclerosis

Sirs,

Plantar fat-pad atrophy is a progressive and disabling condition that commonly occurs in systemic sclerosis (SSc). The fibrotic counterpart of the disease gives rise to subcutaneous atrophy of the foot including the plantar fat-pads (1), which are specialised compartments of fat globules providing shock absorption over the metatarsal heads and heel to facilitate their weight-bearing function (2). Fat-pad atrophy precipitates foot pain that can limit mobilisation and activities of daily living, impacting work and financial income, with significant psychological morbidity (3). Autologous fat grafting (AFG) is gaining popularity as a method of soft tissue reconstruction as it offers a minimally invasive procedure that utilises the patients' own tissue reserves (4). There are only limited reports on its use for plantar fat-pad atrophy (3, 5-6). We describe our technique and experience of using AFG in SSc patients with plantar fat-pad atrophy.

We performed AFG using the technique described by Coleman (7). Fat was harvested predominantly from the abdomen or thighs using a cannula connected to a 10ml syringe. The lipoaspirate was centrifuged at 3000 rpm for 3 minutes. The proximal portion consisting of free oil and blood was discarded, and the remaining portion comprised of adipose cells was injected into the base of the metatarsal heads or heels using a blunt cannula connected to a 1ml syringe (Fig. 1). Post-operatively patients were instructed to be partial weight bearing for two weeks. Patients were followed-up in the outpatients clinic at 6 weeks to 3 months. Nine female patients were treated with 18 fat grafting procedures between November 2009 and November 2019. All patients had a diagnosis of SSc and presented with symptoms of plantar fat pad atrophy that was being managed conservatively. Average age at surgery was  $60 \pm 7.90$  years. Fat was harvested from the abdomen (89%) or thighs (11%) and transferred to one (67%) or both feet (33%). A mean volume of  $4.22 \pm 1.93$ ml was injected per foot in each procedure. Patients underwent an average of 2 procedures (range 1-3) in total over  $34.5 \pm 14.10$  months, with an average of  $23 \pm 14.7$  months between each procedure. Post-operatively patients reported a global improvement in pain and mobility at 3 to 6 months. Three patients went on to have other surgical procedures but ceased to require further fat grafting. Management of plantar fat-pad atrophy largely involves the use of external cushioning devices or orthotics to alleviate



**Fig. 1.** Fat is injected to the base of the metatarsal heads as marked.

pedal pressures, but there is risk of adjacent tissue breakdown and a requirement for rigid compliance (2). Synthetic fillers such as liquid silicone are prone to migration with recurrence of symptoms and have an added risk of foreign body response (3). Surgical reconstruction using local or distant flaps confers greater morbidity than benefit in this context, and skin grafts are unsuitable for weight bearing (8). Fat grafting offers a novel therapeutic approach using autologous tissue to restore plantar fat-pad volume. In addition it contains adipose-derived stem cells (ADSCs) with regenerative potential (4). AFG has been reported to significantly improve foot pain in patients with plantar fat-pad atrophy (3, 6). An ongoing and persistent improvement in pain and function was reported at 24 months post-op despite apparent resorption of the fat graft and return of soft-tissue thickness back to baseline in less than 6 months (6). A further study from the same group showed that pedal dermal thickness increased by 6 months that persisted at 24 months (5), giving plausible explanation to the improvement in symptoms.

The consequences of plantar foot atrophy can be significant and disabling. Fat transfer offers a treatment modality that is safe and minimally invasive. It is hypothesised that the regenerative effect of adipose stem cells serves to increase pedal dermal thickness contributing to improvement in symptoms despite reabsorption of fat.

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