Ultrasound changes of adipose tissue following treatment with High Intensity Focused Ultrasound

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Introduction
High intensity focused ultrasound (HIFU) has been employed therapeutically for many years in other areas of medicine. With focused ultrasound the energy is too low to cause damage as it passes through the skin. However, it rises to therapeutic levels in the tissue and is able to destroy adipose cells (Fig 1). The destruction of adipose tissue by the LipoSonix HIFU system has been shown histologically.

Aim
To see if Greyscale Ultrasound would be able to non-invasively monitor the lesions in the adipose tissue caused by the LipoSonix HIFU system. This would not subject patients to the invasive harvesting of treated adipose tissue.

Patients and Methods
A 47 year old healthy male volunteer underwent treatment of the right abdomen only. The left abdomen was preserved as a control. The protocol was 2 passes at 74 Jcm⁻² at 1.8cm and 1.1cm depths. Scans took place immediately before treatment, immediately post treatment and subsequently at 1 and 3 days, as well as 2, 3, 8 and 10 weeks after treatment. At each scan an image of the right (treated) and left (untreated) sides were recorded.

Results
Prior to treatment there was no difference between the left (Fig 2) and right sides. Post treatment there was an immediate increase in echogenicity (seen as an increased whiteness on ultrasound) of the right side (Fig 3). This represents the morphological change in the tissue immediately post treatment. Comparing the results at week 2 (Fig 4 and Fig 5) the treated tissue has continued to become increasingly hyperechoic, although the echogenic regions have become more diffuse. Also at 2 weeks, we observe the appearance of loculations (Fig 6). At 10 weeks the untreated side (Fig 7) was almost identical to the treated side (Fig 8).

Discussion
The immediate increase in echogenicity is likely to be due to the destruction of adipose tissue causing the influx of blood constituents. This correlates with clinical findings of bruising and discomfort associated with the procedure.

The loculations could be formed by either by inflammatory oedema, extracellular lipid or a combination of both. We were unable to aspirate these loculations for analysis but we hope to do this in the future.

Conclusions
The physical changes caused by the LipoSonix device, previously described histologically, can be observed on Grey Scale ultrasound. We suggest that this technique would be appropriate for monitoring patients undergoing this treatment if required, and also for comparing different methods of non-invasive lipolysis.

References
5. Gadsden E, Smoller B, Aguilar MT, Jewell M, Guiag R. The clinical safety and histologic changes associated with the use of a novel high-intensity focused ultrasound device for noninvasive body sculpting.