Correspondence

Heating rheumatoid knees to an intra-articular temperature of 42.1°C

SIR, Heat therapy provides comfort for patients with rheumatoid arthritis (RA), but most modalities transfer heat only a few millimetres beneath the skin surface.¹⁻³ A new method uses a magnetrotor to create electromagnetic fields that flow parallel to tissue layer boundaries and distribute more heat in deeper tissue than near the surface, thus effectively heating the deep tissues without surface tissue injury.^{4,5}

Five patients with classical RA consented to undergo hyperthermia treatment. Each had active inflammation and effusion of a knee. A sterile thermistor was introduced through an indwelling plastic catheter into the patellofemoral joint space. Patellofemoral joint, skin (over the treated knee), and oral temperatures were recorded at baseline and at 15 minute intervals during one hour of treatment to determine if a magnetrotor could be used safely to increase intra-articular temperature. The procedure was done on alternate days, three times for four patients and twice for one patient. Baseline therapy with anti-inflammatory medications was not changed during the study. To simulate more closely the circumstances in which heat therapy is generally applied the synovial fluid was not aspirated.

Absorbed power (100-200 W) was applied with radio-frequency waves of 13.56 MHz. The mean temperature of the patellofemoral joints at baseline was 36.6 (SD 0.75)°C, at 15 minutes 41.6 (0.80)°C, at 30 minutes 42.1 (1.0)°C, at 45 minutes 41.7 (0.86)°C, and at 60 minutes 42.0 (0.89)°C (Fig. 1). Superficial skin temperature at baseline was 33.7 (0.89)°C and rose to a mean of 37.2 (1.9)°C. Oral temperatures were unchanged during treatment and at follow up examinations. Overall, the mean intra-articular temperature increase was 5.2°C (95% confidence interval 4.9-5.6°C). Magnetrotor treatment increased the intra-articular temperature 1.9°C (95% confidence interval 1.2-2.5°C) more than it increased the skin temperature ($p < 0.05$).

All patients noted a sensation of warmth or heat in the treated knee. One patient developed a 1×3 cm superficial skin blister in the popliteal area that healed in three weeks. Clinical measurements of the degree of swelling and range of motion (148° pretreatment; 145° post-treatment) of the treated knees were unchanged by the heat therapy. After each heat treatment the patients recorded subjective assessments of their general health, RA in general, and the arthritis of the treated knee, using visual analogue scales. There was no trend towards improvement or deterioration of general health or of RA in general. The arthritis of the treated knee was felt to be

Fig. 1 Intra-articular and superficial skin temperature during magnetrotor induced heating of the knee.

less severe after eight heat treatments, more severe after two, and unchanged after four treatments.

We conclude that intra-articular temperatures can be increased substantially by magnetrotor induced hyperthermia, but there was little evidence of clinical benefit in the five patients who were treated.

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References

- Horvath S M, Hollander J L. Intra-articular temperature as a measure of joint reaction. *J Clin Invest* 1949; **28**: 469-73.
- Hollander J L, Stoner E K, Brown E M Jr, et al. Joint temperature measurement in the evaluation of anti-arthritis agents. *J Clin Invest* 1951; **30**: 701-6.
- Hollander J L, Horvath S M. The influence of physical therapy procedures on the intra-articular temperature of normal and arthritic subjects. *Am J Med Sci* 1950; **218**: 543-8.
- Storm F K, Harrison W H, Elliott R S, Hatzitheofilou C, Morton D L. Human hyperthermic therapy: Relation between tumor type and capacity to induce hyperthermia by radiofrequency. *Am J Surg* 1979; **138**: 170-4.
- Storm F K, Elliott R S, Harrison W H, et al. Clinical radiofrequency hyperthermia by magnetic-loop induction — a new approach to human cancer therapy. *IEEE Trans Biomed Eng* 1982; **MTT30**: 1149-58.