

• DOES HAVE LOW-ENERGY NMR AN EFFECT ON MODERATE GONARTHROSIS ?

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ABSTRACT INTRODUCTION:

Electromagnetic fields can interfere cellular mechanisms in bone and cartilage, e.g. stimulation of growth factors like TGF-beta and bone morphogenetic proteins (1). Pulsed electromagnetic fields (PEMF) were shown to have effect on chondrocytes and osteoblasts *in vitro* as in arthrosis in Hartley guinea pigs (2). Magnetic fields also resolved in less experimental inflammatory synovitis in rats (3). Effect in clinical studies could have been shown (4,5).

A further development could be the treatment with nuclear magnetic resonance (NMR), in which a permanent magnetic field is combined with an interfering field. Hereby magnetic resonance of molecules can be achieved.

The aim of this study was to investigate the effect of low-energy NMR on the posttraumatic gonarthrosis in the rabbit macroscopical and histological.

METHODS:

In 12 skeletally mature NZW rabbits (authorized by local authorities G17/04), the anterior cruciate ligament (ACL) was resected in both knees to create anterior instability of the knee. Postoperatively, the animals were allowed to move free. Thereby a posttraumatic osteoarthritis developed in both knees.

After 6 weeks the animals were randomized in two groups. The test group (eight animals) was treated by NMR (magnetic field: 20-40 Gauss, interference field: 2,35 mT, 100 KHz; MBST®Device, MedTec, Germany), with one hour of treatment for seven consecutive days. The sham group received no treatment. Seven days after the last treatment all animals were killed and macroscopic and histological scores were evaluated.

The macroscopic score was evaluated by 2 independent investigators according to the score of Tibesku et al. (6) using a grading system consisting of 4 different criteria: fibrillations and ulcerations of the hyaline cartilage, osteophyte formation, and joint effusion. The total score ranged from 0 to 11, with 0 being a macroscopically intact knee joint and 11 being late-stage OA. After macroscopic grading, knee joints were immediately stored at -80°C until further examination. The histological score was performed according to the Mankin score.

Statistical analysis was performed using the Statistical Package for Social Sciences, release 11.0 (SPSS, Munich, Germany). Mann-Whitney-U-test was performed. *P* values less than 0.05 were considered significant.

RESULTS:

Macroscopical there was significantly lower score in the test group compared to the control-group for osteophyte formation (mean ± SD 1,06 ± 0,68 vs. 2,12 ± 1,12; *p*<0.05). There was no significant difference in fibrillations (mean ± SD 1,56 ± 0,72 vs. 1,88 ± 0,83), ulcerations (mean ± SD 0,5 ± 0,52 vs. 0,75 ± 0,7) and joint effusion (mean ± SD 1,31 ± 0,95 vs. 4,25 ± 6,84). The overall macroscopic score in the test group was also significant lower compared to the control group (mean ± SD 4,44 vs. 6,63; *p*<0.05).

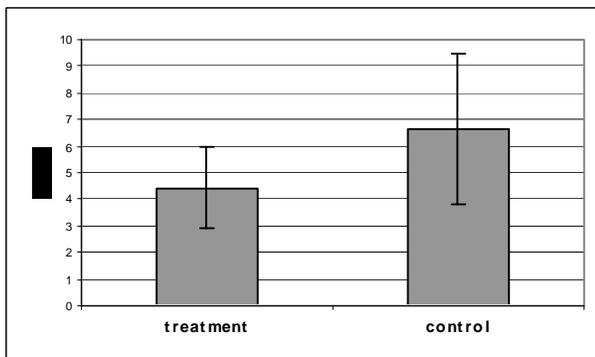


Figure 1 Macroscopic score

Histological there was no significant difference in the Mankin score between the test-group and the control group (mean ± SD 5,7 ± 2,17 vs. 5,11 ± 1,84).

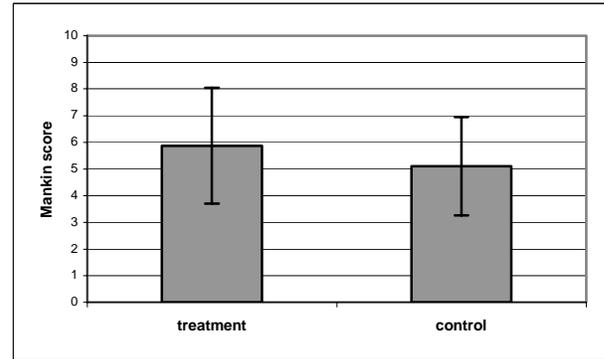


Figure 2: Mankin score

DISCUSSION:

In our investigation we could show a significant macroscopic effect of NMR-treatment in moderate posttraumatic gonarthrosis in rabbit.

Main effect was observed in the development of osteophytes. The reason for this difference is unknown. As PEMF is known to have influence on bone development, as seen in non-unions, NMR might have a similar effect.

Although there was no significant difference in joint effusion, a trend to less effusion in the test group was observed. As it is known that synovitis leads to joint effusion which is seen in osteoarthritis clinically. Our results might indicate less inflammation and would therefore positively match to the study of Weinberger et al. who have shown less synovitis in treatment with magnetic fields *in vivo*.

However, our results showed no significant differences in the histologic stains according to the Mankin score, an established parameter for the integrity of the articular surface. Perhaps arthrosis was not severe enough and current investigations in severe arthrosis will show an effect.

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