Paper read at the 1st Joint Congress for Orthopaedic Medicine and Trauma Surgery, Berlin, October 19-22, 2005.

Prospective Study over a period of 1 Year in respect to the effectiveness of the MBST®-NuclearMagneticResonanceTherapy as used during the conservative therapy of Gonarthrosis

Auerbach B.[1], Yacoub A.[2], Melzer C.[1]
[1]Waldkrankenhaus Bad Düben, Fachkrankenhaus für Orthopädie, [2]Orthopädische Praxis, Taucha

Introduction:

The MBST®-NuclearMagneticResonanceTherapy is a combination of static and dynamic electromagnetic fields in the form of a coil. The system is used for therapy of disorders of the knee joint. The functional principle is based on the generation of electrical charges that correspond to the energy differentials within the cell (Nucleus and membrane). The charges are induced by applying of a magnetic field with varying field alignment. A defined change in the frequency of the electromagnetic field causes a change of the energy level of the hydrogen nuclei. In that way, ion dynamics are induced, which in turn are intended to change the characteristics of the cellular membrane, their transportation characteristics and the characteristics of the membrane associated receptors. [1]. The ultimate intention is to induce repair activity at the cellular level [2,3] and to enhance the synthesis capacity of the chondrocytes for the extra cellular matrix [4]. The study was carried out using a ring-shaped therapy coil made and supplied by the company MedTec Medizintechnik GmbH, Wetzlar (Germany). The treatment was carried out with field strength of 2.35 mT, a combination of a permanent static field and 12 coil systems, whereby each of the coils can be controlled individually. In this way, a defined dynamic magnetic resonance field with a magnetic resonance frequency of about 100 kHz by a diameter of 300 mm was generated.

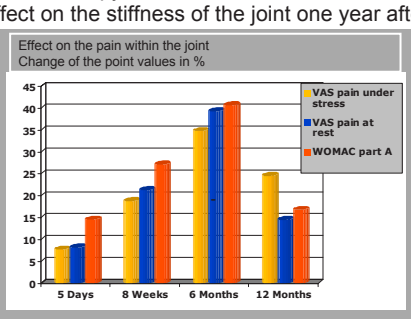
Allgemeine Patientendaten	
Ø Alter (Min./Max.)	48,6 Jahre (34 J./ 70 J.)
Geschlecht	31 Frauen / 29 Männer
Seite links/ rechts	24 / 36
Ø Körpergewicht	81,6 kg
Körpergewicht in % über BROCA	14,5 %

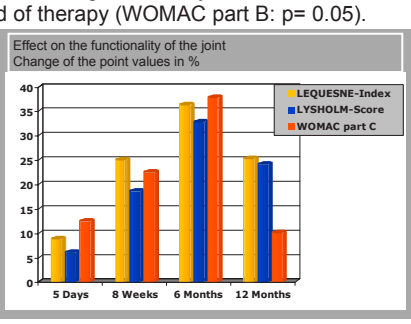
Materials and Methods:

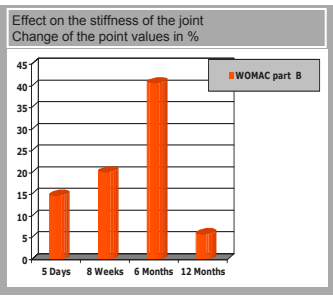
60 Patients with disabilities caused by arthrosis of the knee joint were treated with the MBST®-Magnetic Resonance therapy at the clinic in Bad Düben during the period of February through November of 2002. The patients were treated for 1 hour during 5 days. The success of the therapy was evaluated prospectively over a period of 1 years using the LEQUESNE-Index, WOMAC (parts A, B, C), LYSHOLM-Score and VAS (Pain at rest and pain under stress). We registered the data of 59 patients before and immediately after the therapy, as well as 8 weeks, 6 months and one year after the end of the treatment. The data thus compiled was statistically compared using the WILCOXON-Test [5]. The diagnostics of the cartilage damage was evaluated in part using arthroscopic methods according to Outerbridge (33 patients), the other part using the x-ray method according to Kellgren und Lawrence (27 patients).

Results:

All patients evaluated the MBST®-NuclearMagneticResonanceTherapy as positive, having no side effects, causing no pain or any other disagreeable effects. None of the patients stopped the treatment before its completion. At the end of the therapy (5 days) the point values of the scores were significantly improved from 6 - 14.5 O/O. This improvement increased during the following 8 weeks to changes between 18.59 and 27.16 %. At the end of the 6 month evaluation period, the maximum changes of 32 to 40 % were reached. At the end of the 1 year evaluation period, improvements of 5.8 to 25 O/D in comparison to the values obtained before the beginning of the treatments were still verifiable.
Using the WILCOXON-Test, a significant change of all score developments (5 days, 8 weeks, 6 months, and 1 year) as compared to the values before therapy could be established for the entire period lasting until one year after the end of the treatment. The only exception to this was the effect on the stiffness of the joint one year after the end of therapy (WOMAC part B: p= 0.05).







Discussion:

The functionality of the MBST®-NuclearMagneticResonanceTherapy is based on magnetic resonance as it is used for diagnostic purposes. Froböse et al. [6] quantitatively examined the effect of magnetic resonance in MRI after 10 weeks and considered the positive changes within the cartilage structures to be caused by the activation of intact cartilage cells and the stimulation of collagen synthesis. Temiz-Artmann et al. [7] showed in an in vitro study that human chondrocytes were positively influenced in respect to their cellular growth rate after therapy as compared to a placebo group. Hitherto, no further publications in respect to this therapy system have become available. For that reason, the results must be compared to those of obtained with other systems. The producer of the appliance refers to differences in respect to the functional principle of the system as compared with pulsating electro-magnetic fields. In the Cochrane Review of 2002 which comprises 102 studies in respect to "Electromagnetic fields used in the therapy of Osteoarthrosis" only three double-blind, placebo-controlled studies stood up to the evaluation criteria [8]. In their studies, Trock [9,10] as well as Zizic [ll] were able to show statistically significant improvements of 13-23 % in respect to the clinical parameters of gonarthrosis. The follow-up period for these studies was 4-6 weeks. Our results obtained after the 8 week evaluation period thus correspond to the values available in the pertinent literature. Furthermore, for the period between 8 weeks and 6 months after the end of the therapy, we have obtained an additional significant improvement of 11-20 % for the different scores. We have followed up the study prospectively for 12 months to be able to obtain an evaluation of the duration of the effect in respect to pain and arthrosis scores. All scores were significantly improved over the entire study duration as compared to the values before therapy. The only exception to these results was the data obtained for the stiffness of the joint after 1 year (WOMAC Part C), where the maximum effect was at 6 months. In conclusion, we can say, that the results obtained in this study have caused used to firmly incorporate the MBST®-NuclearMagneticResonanceTherapy into the conservative treatment of arthrosis with symptom modifying impact.

Literature:
1 Aaron RK, Ciombor DM, Keeping H, Wang S, Capuano A, Polk C (1999) Power frequency fields promote cell differentiation coincident with an increase in transforming growth factor-beta (1) expression. *Bioelectromagnetics,* Oct 20 (7): 453-458. **2** Lippiello L, Chakkalakal D, Connolly JF (1990) Pulsing Direct Current-Induced Repair of Articular Cartilage in Rabbit Osteochondral Defects. *Journal of Orthopaedic Research,* Vol. 8: 266-275. **3** Indouraine A, Petersen JP, Pforringer W (2001) Effects of low-frequency pulsed electromagnetic fields on the proliferation of chondrocytes. *Sportverletz. Sportschaden,* 15(1): 22-27. **4** Liu H, Abbott J, Bee JA (1990) Pulsed electromagnetic fields influence hyaline cartilage extracellular matrix composition without affecting molecular structure. *Osteoarthritis Cartilage,* 4: 63-76. **5** Trampisch HJ, Windeler J, Ehle B, Lange St (eds.) (1997) Medizinische Statistik. Berlin, Heidelberg, New York: Springer-Verlag. **6** Froböse I, Eckey U, Reiser M, Glaser C, Engelmeier F, Assheuer J, Breitgraf G (2000) Evaluation der Effektivität dreidimensionaler pulsierender elektromagnetischer Felder der MultiBioSignal-Therapie (MBST) auf die Regeneration von Knorpelstrukturen. *Orthopädische Praxis,* 36: 510-515. **7** Temiz-Artmann A, Lindner P, Kayser P, Digel I, Artmann GM, Lücker P (2005) NMR in vitro effects on proliferation, Apoptosis, and viability of human chondrocytes and osteoblasts. *Methods. Find. Exp. Clin. Pharmacol.,* 27 (6): 391-394. **8** Hulme J, Robinson V, DeBie R, Wells G, Judd M, Tugwell P (2002) Electromagnetic fields for the treatment of osteoarthritis. *Cochrane Database Syst. Rev.,* 1: CD 003523. **9** Trock DH, Bollet AJ, Dyer RH Jr, Fielding LP, Miner WK, Markoll R (1993) A double-blind trial of the clinical effects of pulsed electromagnetic fields in osteoarthritis. *Journal of Rheumatology,* 20 (3): 456-460. **10** Trock DH, Bollet AJ, Markoll R (1994) The effect of pulsed electromagnetic fields in the treatment of osteoarthritis of the knee and cervical spine. Report of randomized, double blind, placebo controlled trials. *Journal of Rheumatology,* 21 (10): 1903-1911. **11** Zizic TM, Hoffman KC, Holt PA, Hungerford DS, O'Dell JR, Jacobs MA (1995) The treatment of osteoarthritis of the knee with pulsed electrical stimulation. *Journal of Rheumatology,* 22: 1757-1761

Please send all correspondence regarding this study to: Dr. med. Babett Auerbach, Waldkrankenhaus Bad Düben. Gustav-Adolfstr. 15a, 04849 Bad Düben. Tel.: +49 (0)34243-761006, E-Mail: auerbach@dueben.medicline.de