

Research Annual Report 2007



Musculoskeletal Science Center (MUSC)

Biomechanics of posture and movement, anatomy and medical technology

Onset, course and outcome of inflammatory arthritis (RA) and osteoarthritis

Measurement (of the results of intervention) in rehabilitation medicine

Efficiency and efficacy of trauma care

Biology and technology of reconstructive surgery

The musculoskeletal system and tissue-engineering in orthopaedics and otorhinolaryngology

EMC MUSC-01-19-01 - Biomechanics of posture and movement, anatomy and medical technology

Programme design in brief

General objectives:

This project focuses on the solving of locomotor problems by means of biomechanical and functional anatomical principles. Aim of the project is:

1. to clarify causes of common dysfunctions by analyzing the relationships between mechanical load and lesions of bones, capsule, ligaments, fascia, muscles and nerves;
2. to develop special experimental devices for medical research and devices for the treatment, rehabilitation and prevention of chronic diseases.

Key figures

Department	SP1	SP2	SP3	SP4	SPtot	T1	T2	T3	Ttot	IS	FS	OP	Ptot
biomedical physics & technology	0,45	0	0	0	0,45								
Total	0,45	0	0	0	0,45	0	0	0	0	3	0	2	5

Article/Letter to the editor

Albayrak, A., Veelen, M.A. van, Prins, J.F., Snijders, C.J., Ridder, H. de & Kazemier, G. (2007). A newly designed ergonomic body support for surgeons. *Surgical Endoscopy-Ultrasound and Interventional Techniques*, 21(10), 1835-1840.

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Ponsen, K.J., Joosse, P., Dijke, GAH van & Snijders, C.J. (2007). External fixation of the pelvic ring - An experimental study on the role of pin diameter, pin position, and parasymphseal fixator pins. *Acta Orthopaedica*, 78(5), 648-653.

Pool-Goudzwaard, A.L. (2007). Bekkenbodemdisfuncties bij patiënten met 'bekkeninstabiliteit'. *Tijdschrift voor Kinesitherapie*, 2(3), 3-8.

Part of book - abstract

Albayrak, A. & Snijders, C.J. (2007). Ergonomics in the OR. In J.B. Trimbos & T.C.M. Trimbos-Kemper (Eds.), *Basics of surgery; tools, techniques, attitude and expertise; part IV protecting the surgeon*. Maarssen: Elsevier Gezondheidszorg.

EMC MUSC-01-31-01 - Onset, course and outcome of inflammatory arthritis (RA) and osteoarthritis

Programme design in brief

The programme investigates onset, course and outcomes of early (rheumatoid) arthritis. It aims to find determinants for disease onset and severity and subsequently to develop predictive algorithms for diagnosis and prognosis. In the scope of the disease course the effect of various medical and non-medical interventions are studied.

Key figures

Department	SP1	SP2	SP3	SP4	SPtot	T1	T2	T3	Ttot	IS	FS	OP	Ptot
biomedical physics & technology	5	0	1,75	1	7,75								
Total	5	0	1,75	1	7,75	0	0	0	0	13	0	0	13

Article/Letter to the editor

Alizadeh, B.Z., Njajou, OT, Hazes, J.M.W., Hofman, A., Slagboom, P.E., Pols, H.A.P. & Duijn, C.M. van (2007). The H63D variant in the HFE gene predisposes to arthralgia, chondrocalcinosis and osteoarthritis. *Annals of the Rheumatic Diseases*, 66(11), 1436-1442.

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Dahaghin, S., Bierma-Zeinstra, S.M.A., Koes, B.W., Hazes, J.M.W. & Pols, H.A.P. (2007). Do metabolic factors add to the effect of overweight on hand osteoarthritis? The Rotterdam Study. *Annals of the Rheumatic Diseases*, 66(7), 916-920.

Escorpizo, R, Bombardier, C., Boonen, A., Hazes, J.M.W., Lacaille, D, Strand, V & Beaton, D (2007). Worker productivity outcome measures in arthritis. *Journal of Rheumatology*, 34(6), 1372-1380.

Geijn, F.E. van de, Dolhain, R.J.E.M., Rijs, W. van, Hazes, J.M.W. & Groot, C.J.M. de (2007). Mannose-binding lectin genotypes and pre-eclampsia: a case-control study. *Human Immunology*, 68(11), 888-893.

Geijn, F.E. van de, Roos, A. de, Man, Y.A. de, Laman, J.D., Groot, C.J.M. de, Daha, M.R., Hazes, J.M.W. & Dolhain, R.J.E.M. (2007). Mannose-binding lectin levels during pregnancy: a longitudinal study. *Human Reproduction*, 22(2), 362-371.

Geuskens, G.A., Burdorf, A. & Hazes, J.M.W. (2007). Consequences of rheumatoid arthritis for performance of social roles - A literature review. *Journal of Rheumatology*, 34(6), 1248-1260.

Goekoop-Ruiterman, YPM, Vries-Bouwstra, JK de, Allaart, CF, Zeven, D van, Kerstens, PJSM, Hazes, J.M.W., Zwinderman, A.H., Peeters, A.J., Jonge-Bok, JM de, Mallee, C, Beus, WM de, Sonnaville, PBJ de, Ewals, F.V.P.M., Breedveld, F.C. & Dijkmans, B.A.C. (2007). Comparison of treatment strategies in early rheumatoid arthritis - A randomized trial. *Annals of Internal Medicine*, 146(6), 406-415.

Kooij, SM van der, Vries-Bouwstra, JK de, Goekoop-Ruiterman, YPM, Zeven, D van, Kerstens, PJSM, Gerards, AH, Groenendaal, JHLM van, Hazes, J.M.W., Breedveld, F.C., Allaart, CF & Dijkmans, B.A.C. (2007). Limited efficacy of conventional DMARDs after initial methotrexate failure in patients with recent onset rheumatoid arthritis treated according to the disease activity score. *Annals of the Rheumatic Diseases*, 66(10), 1356-1362.

Kroot, E.J.A., Hazes, J.M.W., Colin, E.M. & Dolhain, R.J.E.M. (2007). Poncet's disease: reactive arthritis accompanying tuberculosis. Two case reports and a review of the literature. *Rheumatology*, 46(3), 484-489.

Man, Y.A. de, Hazes, J.M.W., Geijn, F.E. van de, Krommenhoek, C. & Dolhain, R.J.E.M. (2007). Measuring disease activity and functionality during pregnancy in patients with rheumatoid arthritis. *Arthritis & Rheumatism*, 57(5), 716-722.

Reijman, M., Pols, H.A.P., Bergink, A.P., Hazes, J.M.W., Belo, J.N., Lievense, A.M. & Bierma-Zeinstra, S.M.A. (2007). Body mass index associated with onset and progression of osteoarthritis of the knee but not of the hip: The Rotterdam Study. *Annals of the Rheumatic Diseases*, 66(2), 158-162.

Wuhrer, M, Stam, JC, Geijn, F.E. van de, Koeleman, CAM, Verrips, CT, Dolhain, R.J.E.M., Hokke, CH & Deelder, A.M. (2007). Glycosylation profiling of immunoglobulin G (IgG) subclasses from human serum. *Proteomics*, 7(22), 4070-4081.

EMC MUSC-01-46-01 - Measurement (of the results of intervention) in rehabilitation medicine

Programme design in brief

Rehabilitation medicine is the medical specialism which concerns the diagnostic procedures and treatment of permanent, imminent and complex consequences of diseases, trauma and congenital deformities.

Research and development in rehabilitation medicine is to a large extent interdisciplinary and aims at research questions in the field of medicine, technology, psychology, physiotherapy, occupational therapy, sociology, etc. As a result the objective, reliable and valid measurement of impairment, disability and handicap has been developed insufficiently and existing methods are not appropriate for implementation in patient related research. The main points of the programme are:

1. The development, validation and application of new diagnostic instruments for the purpose of low back and pelvic complaints and for the purpose of pathology of the hand and wrist area.
2. The development, validation and application of long term ambulant registration of posture, movement, activity and cardiac stress for the purpose of patients with amputation, chronic pain, cardiac failure and the elderly.
3. The study of functional prognosis and outcome in patients with traumatic brain and spinal cord injury.
4. The study of physical, social and psychological impairment and disability in adolescents and adults with (congenital) disorders in childhood

Key figures

Department	SP1	SP2	SP3	SP4	SPtot	T1	T2	T3	Ttot	IS	FS	OP	Ptot
family practice	0,3	0	0	0	0,3								
plastic and reconstructive surgery	0	0	0	0,05	0,05								
rehabilitation	1,73	5	0,8	1,85	9,38								
Total	2,03	5	0,8	1,9	9,73	1	0	0	1	23	1	6	31

Theses

Sandt-Koenderman, W.M.E. (2007, juni 06). Crossroads in aphasia rehabilitation. EUR (189 pag.). Prom./coprom.: Prof.Dr. H.J. Stam.

Article/Letter to the editor

Baalen, J.T.M. van, Ribbers, G.M., Medema-Meulepas, D, Pas, M.S., Odding, E. & Stam, H.J. (2007). Being restricted in participation after a traumatic brain injury is negatively associated by passive coping style of the caregiver. *Brain Injury*, 21(9), 925-931.

Berg-Emons, H.J.G. van den, Schasfoort, F.C., Vos, L.A.J. de, Bussmann, J.B. & Stam, H.J. (2007). Impact of chronic pain on everyday physical activity. *European Journal of Pain-London*, 11(5), 587-593.

Bruinings, AL, Berg-Emons, H.J.G. van den, Buffart, L.M., Heijden-Maessen, HCM van der, Roebroek, M.E. & Stam, H.J. (2007). Energy cost and physical strain of daily activities in adolescents and young adults with myelomeningocele. *Developmental Medicine & Child Neurology*, 49(9), 672-677.

Buffart, L.M., Roebroek, M.E., Janssen, W.G.M., Hoekstra, A., Hovius, S.E.R. & Stam, H.J. (2007). Comparison of instruments to assess hand function in children with radius deficiencies. *Journal of Hand Surgery-American Volume*, 32A(4), 531-540.

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Bussmann, J.B., Garssen, M.P., Doorn, P.A. van & Stam, H.J. (2007). Analysing the favourable effects of physical exercise: Relationships between physical fitness, fatigue and functioning in Guillain-Barre syndrome and chronic inflammatory demyelinating polyneuropathy. *Journal of Rehabilitation Medicine*, 39(2), 121-125.

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Ginneken, B.T.J. van, Berg-Emons, H.J.G. van den, Kazemier, G., Metselaar, H.J., Tilanus, H.W. & Stam, H.J. (2007). Physical fitness, fatigue, and quality of life after liver transplantation. *European Journal of Applied Physiology*, 100(3), 345-353.

Haisma, J., Bussmann, J.B.J., Stam, H.J., Sluis, T.A.R., Bergen, M.P., Post, MWM, Dallmeijer, AJ & Woude, L.H.V. van der (2007). Physical fitness in people with a spinal cord injury: the association with complications and duration of rehabilitation. *Clinical Rehabilitation*, 21(10), 932-940.

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- Haisma, J.A., Woude, LH van der, Stam, H.J., Bergen, M.P., Sluis, T.A., Groot, S. de, Dallmeijer, AJ & Bussmann, J.B. (2007). Prognostic models for physical capacity at discharge and 1 year postdischarge from rehabilitation in persons with spinal cord injury. *Archives of Physical Medicine and Rehabilitation*, 88(12), 1694-1703.
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Book editorship

Mens, J.M.A. (Ed.). (2007). *Bekkeninstabiliteit*. Houten: Bohn Stafleu van Loghum.

Mens, J.M.A. (Ed.). (2007). *Bekkeninstabiliteit diagnostiek en therapie*. Houten: Bohn Stafleu van Loghum.

EMC MUSC-01-47-01 - Efficiency and efficacy of trauma care

Programme design in brief

The main objective of this programme is to investigate the efficiency and efficacy of management and treatment approaches for trauma patients.

The basic research projects aim at getting insight into fracture healing.

Fractures that do not heal uncomplicated often require bone grafting. Literature data of bone substitute materials available in the Netherlands will be collected. The biomechanical and biological characteristics in vivo will be determined. Finally, a clinical guideline for surgical use of these products will be made.

Literature data imply that Pulsed ElectroMagnetic Fields (PEMF) induce osteosynthesis. The effect of PEMF on osteoinduction will be studied in chondrocytes and in patients who sustained a tibia fracture.

Advanced trauma life support (ATLS) propagates the use of pelvic circumferential compression devices (PCCDs) for reducing and stabilizing pelvic fractures, however their clinical benefits and risks are largely unknown. The mechanical effects, the quality of pelvic reduction and the decubitus risk of PCCDs will be determined.

The aim of the clinical research projects is to compare management approaches for several fracture types using prospective multi-centre randomized controlled trials (RCT).

For displaced intra-articular calcaneal fractures, outcome after open reduction and internal fixation versus percutaneous surgery versus conservative treatment will be compared. Prior to this, fracture classification and clinical outcome scoring systems, the gait pattern and long-term outcome after percutaneous surgery will be evaluated.

Two prospective multinational RCTs will be performed in patients with femoral neck fractures, comparing internal fixation methods (dynamic hips screw versus multiple cancellous screws) and prosthesis (hemi-arthroplasty versus total hip replacement). Mortality, rates of revision surgery, quality of life and cost-effectiveness will be evaluated.

Functional and anatomic outcome and quality of life will be evaluated in patients who underwent posttraumatic distraction osteogenesis of the lower extremities.

Two projects aim at identifying patients at risk. Literature data indicate that patients with low Mannose Binding Lectin (MBL) levels due to single nucleotide polymorphisms in the MBL-2 gene are at risk of developing serious infectious complication after transplantation or ICU admission. This association will be investigated in polytrauma and burn patients.

The second project deals with elderly patients reporting to the emergency department for medical assessment after they fell. As these patients may be at risk for falling again, the effects of withdrawal of fall-inducing drugs will be investigated.

In preclinical research the added value of assistance by Helicopter Emergency Medical Services (HEMS) on outcome and quality of life will be studied in polytrauma patients. Effects, costs and benefits will be investigated.

Key figures

Department	SP1	SP2	SP3	SP4	S _{Ptot}	T1	T2	T3	T _{tot}	IS	FS	OP	P _{tot}
surgery	2,15	0	0,65	0,5	3,3								
Total	2,15	0	0,65	0,5	3,3	0	0	0	0	5	4	6	15

Article/Letter to the editor

Berg, H. van den, Lere, S.G., Schipper, I.B. & Patka, P. (2007). Abdominale schotverwondingen: mogelijkheden voor selectief conservatief beleid. *Nederlands Tijdschrift voor Geneeskunde*, 151(15), 841-847.

Frolke, JPM & Patka, P. (2007). Definition and classification of fracture non-unions. *Injury-International Journal of the Care of the Injured*, 38, S19-S22.

Harten, S.M. van, Welling, L., Perez, R.S.G.M., Patka, P., Henny, P. & Kreis, R.W. (2007). Interhospital transportation of mass burn casualties. *European Journal of Trauma and Emergency Surgery*, 33(2), 176-182.

Heetveld, M.J., Raaymakers, ELFB, Luitse, JSK & Gouma, D.J. (2007). Rating of internal fixation and clinical outcome in displaced femoral neck fractures - A prospective multicenter study. *Clinical Orthopaedics & Related Research*, 207-213.

Louwers, Y., Vos, A. de & Beeck, E.F. van (2007). Organisatie en effectiviteit van regionale traumazorg. *Nederlands Tijdschrift voor Traumatologie*, 2, 33-40.

Oprel, P. (2007). Nutritional supplementation decreases hip fracture-related complications. *Nederlands Tijdschrift voor Traumatologie*, 15(2), 64-65.

Overdeest, G.M. & Heetveld, M.J. (2007). Open pelvic fractures: Experience with recombinant factor VIIa, degloving and bowel injury. *Injury-International Journal of the Care of the Injured*, 38(3), 384-391.

Ringburg, A.N., Spanjersberg, W.R., Frankema, S.P.G., Steyerberg, E.W., Patka, P. & Schipper, I.B. (2007). Helicopter emergency medical services (HEMS): Impact on on-scene times. *Journal of Trauma-Injury Infection and Critical Care*, 63(2), 258-262.

Schepers, T., Schipper, I.B., Vogels, L.M.M., Ginai-Karamat, A.Z., Mulder, P.G.H., Heetveld, M.J. & Patka, P. (2007). Percutaneous treatment of displaced intra-articular calcaneal fractures. *Journal of Orthopaedic Science*, 12(1), 22-27.

Schepers, T., Hartog, D. den, Ginai-Karamat, A.Z. & Patka, P. (2007). Posterior capsular avulsion fracture of the calcaneus: an uncommon avulsion fracture. *Journal of Foot & Ankle Surgery*, 46(5), 409-410.

Schepers, T., Ginai-Karamat, A.Z., Mulder, P.G.H. & Patka, P. (2007). Radiographic evaluation of calcaneal fractures: to measure or not to measure. *Skeletal Radiology*, 36(9), 847-852.

Part of book - abstract

Kramer, W.L.M., Patka, P. & Mulder, S. (2007). Veiligheid: preventie van ongevallen bij kinderen. In W.L.M. Kramer, H.J. Ten Duis, S. Ekkelkamp, J.L.L. Kimpen, L.P.H. Leenen & P. Patka (Eds.), *Handboek Kindertraumatologie* (pp. 25-42). De Tijdstroom.

Patka, P., Elst, M. van der, Sackers, R.J.B. & Kramer, W.L.M. (2007). Botgroeistimulatie en botvervangning. In W.L.M. Kramer, H.J. Ten Duis, S. Ekkelkamp, J.L.L. Kimpen, L.P.H. Leenen & P. Patka (Eds.), *Handboek Kindertraumatologie* (pp. 693-699). Utrecht: De Tijdstroom.

Patka, P., Kramer, W.L.M., Bongers, K.J. & Besselaar, P.P. (2007). Onderarmfracturen. In W.L.M. Kramer, H.J. Ten Duis, S. Ekkelkamp, J.L.L. Kimpen, L.P.H. Leenen & P. Pakta (Eds.), *Handboek Kindertraumatologie* (pp. 541-557). Utrecht: De Tijdstroom.

Raaymakers, ELFB, Patka, P., Kramer, W.L.M. & Kampen, A. van (2007). Heupfracturen. In W.L.M. Kramer, H.J. Ten Duis, S. Ekkelkamp, J.L.L. Kimpen, L.P.H. Leenen & P. Patka (Eds.), *Handboek kindertraumatologie* (pp. 571-590). Utrecht: De Tijdstroom.

EMC MUSC-01-50-01 - Biology and technology of reconstructive surgery

Programme design in brief

In reconstructive surgery, closing of bone-, nerve-, muscle-, vascular- and skin defects of either teratological, traumatological or pathological disposition, is endeavoured by transposition, transplantation or replantation of tissue. In all cases the final outcome largely is determined by the process of tissue regeneration as ζ De novo synthesis ζ of fibrous tissue (scar tissue) has a strong negative impact on functional and aesthetic final outcome (tissue adhesions, scar formation, fibrosis, loss of function).

The purpose of this program is the development, registration and evaluation of new reconstructive techniques to repair tissue defects. Furthermore, strategies to decrease the synthesis of fibrous tissue are developed and tested.

1. Short and long term evaluation of peripheral nerve regeneration: electromagnetic registration to measure axonal activity (co-operation with Clin Neurofysiol), functional outcome studies, adhesion studies, neuroma treatment.

2. Short and long term evaluation of tendon repair: functional outcome studies, adhesion studies.

3. Tissue engineering of autologous mucosa and/or fat for facial post-oncology reconstructions: tissue engineering, in vivo angiogenesis, functional outcome.

4. Pathogenesis and treatments of craniofacial malformations, combined with short-term and long-term evaluation (with participation of the Departments of Clinical Genetics, Orthodontics, Maxillofacial Surgery and Paediatric Psychiatry).

5. Genetic and embryologic aspects of congenital malformations of the extremities (with participation of the Departments of Clinical Genetics).

6. General evaluation of new techniques after surgical removal of tumours in the head and neck region.

7. General evaluation of new techniques following hand and general microsurgery

Key figures

Department	SP1	SP2	SP3	SP4	SPTot	T1	T2	T3	Ttot	IS	FS	OP	Ptot
oral and maxillofacial surgery	0,1	0	0	0	0,1								
pediatric psychiatry	0,1	0	0	0	0,1								
plastic and reconstructive surgery	3,4	0	0,75	3,45	7,6								
rehabilitation	0	0	0	0,3	0,3								
Total	3,6	0	0,75	3,75	8,1	2	0	0	2	20	3	4	29

Theses

Ettema, A.M. (2007, februari 07). Carpal tunnel syndrome: the role of the subsynovial connective tissue. EUR. Prom./coprom.: Prof.Dr. S.E.R. Hovius.

Roelfsema, N.M. (2007, oktober 01). Three-dimensional ultrasound study of fetal craniofacial anatomy. EUR. Prom./coprom.: Prof.Dr. J.W. Wladimiroff & Dr. S.O.P. Hofer.

Article/Letter to the editor

Buffart, L.M., Roebroek, M.E., Janssen, W.G.M., Hoekstra, A., Hovius, S.E.R. & Stam, H.J. (2007). Comparison of instruments to assess hand function in children with radius deficiencies. *Journal of Hand Surgery-American Volume*, 32A(4), 531-540.

Djasim, U.M.D., Wolvius, E.B., Neck, J.W. van, Weinans, H. & Wal, K.G.H. van der (2007). Recommendations for optimal distraction protocols for various animal models on the basis of a systematic review of the literature. *International Journal of Oral and Maxillofacial Surgery*, 36(10), 877-883.

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EMC MUSC-01-51-01 - The musculoskeletal system and tissue-engineering in orthopaedics and otorhinolaryngology

Programme design in brief

The main purpose of this program is to study the basic principles of growth, healing, ageing and degeneration of bone, cartilage and tendon tissue relative to orthopaedics and otorhinolaryngology. Bone and cartilage tissues grow from the undifferentiated mesenchymal pre-stage to a mechanically load bearing matrix. Critical stages in this pathway are dictated by molecular and mechanical stimuli. In adult stages and particularly during healing the same stimuli are still active, albeit their influence is usually less strong than during development. Surgery on bone and cartilage for reconstructions in the head and neck region, in joints due to osteoarthritis or osteoporosis and after fractures or injuries is partly based on the self-healing capacity of these tissues. The surgeon mostly tries to create optimal conditions and have the natural stimuli do the recovery processes. The research in this programme involves a fundamental approach, using cell and molecular biology techniques, computer models and imaging techniques and aims to find the essential physical and molecular stimuli to (re)generate cartilage and bone. Cell differentiation stages and appropriate matrix development from cartilage precursor cells is examined and its critical stimuli are influenced. In particular the effects of mechanical forces is studied in cell cultures and computational biology models. The general aim in the cartilage research is to develop an optimal cartilage reconstruction construct, either from a biomaterial, a cultured autograft, bone marrow derived stem cells or a combination. Bioengineering methods are used to stimulate bone and cartilage cells and effects are studied by molecular techniques. Bone tissue from various clinical and animal experimental sources is evaluated using micro-CT scanning and computer models to simulate the bone turnover process.

Clinical studies focus on improved evaluation of reconstruction techniques (e.g. x-ray stereophotogrammetry) and the incorporation of more subtle interventions (e.g. growth factors, electromagnetic stimulation, computer aided surgery). Further work concerns clinical outcome studies with respect to implant surgery, nutra-pharmaceuticals, sport injuries and pediatric orthopaedics.

Key figures

Department	SP1	SP2	SP3	SP4	S _{Ptot}	T1	T2	T3	T _{tot}	IS	FS	OP	P _{tot}
orthopaedics	5,21	3,35	2,69	1,22	12,47								
otorhinolaryngology	0,84	0	0	0	0,84								
Total	6,05	3,35	2,69	1,22	13,31	3	0	0	3	13	3	0	19

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