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Risk factors for long-term failure of orthopaedic medical devices: taking advantage of RSA as an early detection tool

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List of publications

KT van Hamersveld, E den Bakker, AS Nyamtema, T van den Akker, EH Mfinanga, M van Elteren, J van Roosmalen. Barriers to conducting effective obstetric audit in Ifakara: a qualitative assessment in an under-resourced setting in Tanzania. *Tropical Medicine & International Health* 2012; 17: 652–657.

KT van Hamersveld, PJ Marang-van de Mheen, R Tsonaka, ER Valstar, S Toksvig-Larsen. Fixation and clinical outcome of uncemented periapatite-coated *versus* cemented total knee arthroplasty: five-year follow-up of a randomised controlled trial using radiostereometric analysis (RSA). *The Bone & Joint Journal* 2017; 99-B: 1467-76.

KT van Hamersveld, PJ Marang-van de Mheen, HJL van der Heide, HMJ van der Linden-van der Zwaag, ER Valstar, RGHH Nelissen. Migration and clinical outcome of mobile-bearing *versus* fixed-bearing single-radius total knee arthroplasty: a randomized controlled trial. *Acta Orthopaedica* 2018; 89: 190-6.

KT van Hamersveld, PJ Marang-van de Mheen, RGHH Nelissen, S Toksvig-Larsen. Migration of all-polyethylene compared with metal-backed tibial components in cemented total knee arthroplasty: A randomized controlled trial. *Acta Orthopaedica* 2018; 89: 412-7.

KT van Hamersveld, PJ Marang-van de Mheen, RGHH Nelissen, S Toksvig-Larsen. Periapatite coating decreases uncemented tibial component migration: long-term RSA results of a randomized controlled trial and limitations of short-term results. *Acta Orthopaedica* 2018; 89: 425-30.

KT van Hamersveld, PJ Marang-van de Mheen, LA Koster, RGHH Nelissen, S Toksvig-Larsen, BL Kaptein. Marker-based *versus* model-based radiostereometric analysis of total knee arthroplasty migration: a reanalysis with comparable mean outcomes despite distinct types of measurement error. *Acta Orthopaedica* 2019; 90: 366-72.

KT van Hamersveld, PJ Marang-van de Mheen, RGHH Nelissen. The effect of coronal alignment on tibial component migration following total knee arthroplasty: a cohort study with long-term radiostereometric analysis results. *The Journal of Bone and Joint Surgery. American volume* 2019; 101: 1203-12.

S Hasan, **KT van Hamersveld**, PJ Marang-van de Mheen, BL Kaptein, RGHH Nelissen, S Toksvig-Larsen. Migration of a novel 3D-printed cementless *versus* a cemented total knee

Appendices

arthroplasty: two-year results of a randomized controlled trial using radiostereometric analysis. *The Bone & Joint Journal* 2020; 102-B:1016-1024.

KT van Hamersveld, PJ Marang-van de Mheen, R Tsonaka, KG Nilsson, S Toksvig-Larsen, RGHH Nelissen. Risk factors for tibial component loosening: a meta-analysis of long-term follow-up RSA data. *The Journal of Bone and Joint Surgery. American volume* 2021; 103:1115-24.

S Hasan, BL Kaptein, RGHH Nelissen, **KT van Hamersveld**, S Toksvig-Larsen, PJ Marang-van de Mheen. The influence of postoperative coronal alignment on tibial migration after total knee arthroplasty in preoperative varus and valgus knees: a secondary analysis of ten randomized controlled trials using radiostereometric analysis. *The Journal of Bone and Joint Surgery. American volume* 2021; *In press*.

S Hasan, BL Kaptein, PJ Marang-van de Mheen, **KT van Hamersveld**, RGHH Nelissen, S. Toksvig-Larsen. Late stabilization of initial migration following cemented total knee arthroplasty: a 5-year follow-up paper of two randomized controlled trials using radiostereometric analysis. *Acta Orthopaedica* 2021; *In press*.

List of presentations

KT van Hamersveld, ER Valstar, RGHH Nelissen, S Toksvig-Larsen. The effect of Peri-Apatite coating on migration in uncemented total knee arthroplasty. *Oral presentation at the 58th biennial meeting of the NOF, Linköping, Sweden, 27-29 April 2016.*

KT van Hamersveld, PJ Marang-van de Mheen, HJL van der Heide, HMJ van der Linden-van der Zwaag, ER Valstar, RGHH Nelissen. Surgical experience, clinical outcome and migration of mobile-bearing *versus* fixed-bearing TKA. *Oral presentation at the 58th biennial meeting of the Nordic Orthopaedic Federation (NOF), Linköping, Sweden, 27-29 April 2016.*

KT van Hamersveld, ER Valstar, PJ Marang-van de Mheen, RGHH Nelissen and S Toksvig-Larsen. Uncemented Peri-Apatite *versus* cemented TKA: Five-year follow-up of a randomised RSA trial. *Oral presentation at the European the 17th annual meeting of the EFORT, Geneva, Switzerland, 1-3 June 2016.*

KT van Hamersveld, ER Valstar, S Toksvig-Larsen. Implant fixation in cruciate-retaining compared to posterior-stabilized total knee arthroplasty: seven-year follow-up of a randomised RSA trial. *Oral presentation at the 24th annual meeting of the European Orthopaedic Research Society (EORS), Bologna, 14-16 September 2016.* Federation of Orthopaedic Trainees in Europe (FORTE) Award: Best Oral Presentation. Abstract published in *The Bone & Joint Journal, Orthopaedic Proceedings 2017*, 99-B: 109.

KT van Hamersveld, RGHH Nelissen, S Toksvig-Larsen. Fixation of all-polyethylene compared to metal-backed tibial components in cemented condylar-stabilizing total knee arthroplasty. *Oral presentation at the 18th annual meeting of the European Federation of National Associations of Orthopaedics and Traumatology (EFORT), Vienna, Austria, 31 May-2 June 2017.*

KT van Hamersveld, RGHH Nelissen, S Toksvig-Larsen. Migration and radiological appearance of uncemented Titanium tibial components: a randomised controlled trial. *Poster presentation at the 5th International RSA meeting, Adelaide, Australia, 6-8 October 2017.*

KT van Hamersveld, PJ Marang-van de Mheen, S Toksvig-Larsen, KG Nilsson, ER Valstar, RGHH Nelissen. Epidemiological aspects of knee prosthetic loosening. *Oral presentation at the 5th International RSA meeting, Adelaide, Australia, 6-8 October 2017.* Best PhD presentation award.

KT van Hamersveld, PJ Marang-van de Mheen, LA Koster, RGHH Nelissen, S Toksvig-Larsen, BL Kaptein. Marker-based *versus* model-based RSA of TKA migration. *Oral presentation at the 6th International RSA meeting, Aarhus, Denmark, 4-6 April 2019.*

S Hasan, **KT van Hamersveld**, PJ Marang-van Mheen, BL Kaptein, RGHH Nelissen, S Toksvig-Larsen. Migration of an Uncemented 3D-Printed versus Cemented Tibial Component: 2-year follow-up results of a randomised controlled trial. *Oral presentation at the 6th International RSA meeting, Aarhus, Denmark, 4-6 April 2019 & Poster presentation at the 20th annual meeting of the European Federation of National Associations of Orthopaedics and Traumatology (EFORT), Lisbon, Portugal, 5-7 June 2019.*

S Hasan, BL Kaptein, RGHH Nelissen, **KT van Hamersveld**, S Toksvig-Larsen, PJ Marang-van de Mheen. Effect of mechanical alignment in TKA on migration in patients with a preoperative varus or valgus knee: a multicenter, retrospective cohort study of 497 TKR using radiostereometric analysis. *Online oral presentation at the 21st annual meeting of the European Federation of National Associations of Orthopaedics and Traumatology (EFORT), Online (Vienna, Austria), 28-30 October 2020*

KT van Hamersveld, PJ Marang-van de Mheen, R Tsonaka, KG Nilsson, S Toksvig-Larsen, RGHH Nelissen. Migration profiles and risk factors for tibial component loosening: a meta-analysis with individual participant implant migration data based on RSA. *Online oral presentation at the 3rd World Arthroplasty Congress, Online (Munich, Germany), 22-24 April 2021.*

S Hasan, BL Kaptein, PJ Marang-van de Mheen, **KT van Hamersveld**, RGHH Nelissen, S Toksvig-Larsen. Migration of all-polyethylene tibial components compared with metal-backed tibial components The need for mid-term results from randomized controlled trials using radiostereometric analysis. *Poster presentation at the 3rd World Arthroplasty Congress, Online (Munich, Germany), 22-24 April 2021.*

S Hasan, BL Kaptein, PJ Marang-van de Mheen, **KT van Hamersveld**, RGHH Nelissen, S Toksvig-Larsen. Stabilization of continuous migrating tibial components between two and five years: the need for longer term follow-up in RSA studies. *Online oral presentation at the 7th International RSA meeting, Online (Oslo, Norway), 10-12 May 2021 & Online oral presentation at the 22nd annual meeting of the European Federation of National Associations of Orthopaedics and Traumatology (EFORT), Online (Vienna, Austria), 30 June–2 July 2021*

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Curriculum vitae

Koen van Hamersveld was born on the 15th of June, 1989 in Amstelveen, The Netherlands. In 2007, he graduated from secondary school (Het Baken Park Lyceum, Almere) after which he started to study medicine at the Vrije Universiteit Amsterdam. During medical school and several years hereafter, he continued to play field hockey resulting in multiple championships with his club Almeerse, including winning the play-offs in 2015/16 to gain promotion to the men's highest national league.

Playing sports may have instigated his professional interest in orthopaedic surgery and traumatology, which started with elective internships at the VU University Medical Center during the final year of his medical training. After graduating from medical school in 2013, he started to work as an orthopaedic resident (not in training) at The Maartenskliniek, Woerden until January 2015. He then started to work on the research projects described in this thesis, as part of a PhD trajectory at the Department of Orthopaedics at the Leiden University Medical Center under supervision of prof. dr. R.G.H.H. Nelissen, prof. dr. ir. E.R. Valstar and dr. P.J. Marang-van de Mheen. During his PhD, he established international research collaborations and presented his work at multiple international scientific meetings. Following a (still ongoing) fruitful collaboration between the departments of orthopaedics of Leiden and the group of dr. S. Toksvig-Larsen in Hässleholm/Lund, Sweden, dr. S. Toksvig-Larsen was later added as a copromotor of his PhD.

In July 2018, he started his training to become an orthopaedic surgeon at the Department of General Surgery in Westfriesgasthuis, Hoorn, followed by residencies at the Department of Orthopaedics in Haga Hospital in The Hague & Reinier Haga Orthopedic Center in Zoetermeer (2020-2021) and Leiden University Medical Center (2021).