



Universiteit  
Leiden  
The Netherlands

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

Hamersveld, K.T. van

### Citation

Hamersveld, K. T. van. (2021, December 2). *Risk factors for long-term failure of orthopaedic medical devices: taking advantage of RSA as an early detection tool*. Retrieved from <https://hdl.handle.net/1887/3245131>

Version: Publisher's Version

[Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/3245131>

**Note:** To cite this publication please use the final published version (if applicable).

## Author affiliations

Affiliations of contributing authors in order of appearance in this thesis

Koen T van Hamersveld, MD, PhD candidate<sup>1</sup>

Perla J Marang-van de Mheen, PhD, Associate professor, Epidemiologist<sup>2,3</sup>

Rob G H H Nelissen, MD, PhD, Professor, Head of Orthopaedics, Orthopaedic surgeon<sup>1</sup>

Søren Toksvig Larsen, MD, PhD, Associate professor, Orthopaedic surgeon<sup>4</sup>

Huub J L van der Heide, MD, PhD, Orthopaedic surgeon<sup>1</sup>

Henrica M J van der Linden-van der Zwaag, MD, PhD, Orthopaedic surgeon<sup>1</sup>

Edward R Valstar<sup>†</sup>, MSc, PhD, Professor, Head of Biomechanics and Imaging group<sup>1,5</sup>

Roula Tsonaka, MSc, PhD, Assistant professor, Biostatistician<sup>3,6</sup>

Lennard A Koster, MSc, Researcher, RSA specialist<sup>1</sup>

Bart L Kaptein, MSc, PhD, Biomechanical engineer, Senior researcher, RSA specialist<sup>1</sup>

Kjell G Nilsson, MD, PhD, Professor, Orthopaedic surgeon<sup>7</sup>

---

<sup>1</sup> Department of Orthopaedics, Leiden University Medical Center (LUMC), Leiden, The Netherlands

---

<sup>2</sup> Department of Medical Decision Making, LUMC, Leiden, The Netherlands (*until 2019*)

---

<sup>3</sup> Department of Biomedical Data Sciences, LUMC, Leiden, The Netherlands (*newly formed department in 2019*)

---

<sup>4</sup> Department of Orthopaedics, Hässleholm Hospital, Hässleholm, Sweden and Department of Clinical Sciences, Lund University, Lund, Sweden

---

<sup>5</sup> Department of Biomechanical Engineering, Faculty of Mechanical, Maritime, and Materials Engineering, Delft University of Technology, Delft, the Netherlands

---

<sup>6</sup> Department of Medical Statistics and BioInformatics, LUMC, Leiden, The Netherlands (*until 2019*)

---

<sup>7</sup> Department of Surgical and Perioperative Sciences, Orthopaedics, Umeå University, Umeå, Sweden



## 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

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 58<sup>th</sup> 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 58<sup>th</sup> 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 17<sup>th</sup> 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 24<sup>th</sup> 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 18<sup>th</sup> 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 20<sup>th</sup> 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 21<sup>st</sup> 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 3<sup>rd</sup> 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 3<sup>rd</sup> 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 22<sup>nd</sup> annual meeting of the European Federation of National Associations of Orthopaedics and Traumatology (EFORT), Online (Vienna, Austria), 30 June–2 July 2021*

## Dankwoord

Wetenschappelijk onderzoek is teamsport. Velen hebben bijgedragen aan de totstandkoming van dit proefschrift, waarvoor mijn dank. Een aantal mensen wil ik in het bijzonder bedanken voor de kansen die zij mij hebben gegeven en het delen van hun kennis, talent en enthousiasme.

Prof. dr. R.G.H.H. Nelissen, beste Rob, als promotor gaf jij mij de kans dit prachtige traject aan te gaan. Je gaf richting maar liet me vrij om mijn eigen pad naar het einddoel te bewandelen. Het was inspirerend en een waar voorrecht om hierbij jouw onvermoeibare passie voor de orthopaedie en de wetenschap van dichtbij mee te maken. Ik ben blij dat dit nu een vervolg krijgt in de kliniek.

Dr. P.J. Marang-van de Mheen, beste Perla, ik had mij geen betere co-promotor kunnen wensen. Je hebt een uitzonderlijke gave om oog te hebben voor details zonder ook maar een moment het grotere geheel uit het oog te verliezen. Dank voor je snelle reacties op al mijn ingestuurde stukken, vragen en zorgen en bovenal voor je mensenkennis en kwaliteiten om op subtile wijze voor de gewenste verandering te kunnen zorgen.

Dr. S. Toksvig-Larsen, dear Sören, I still do not exactly know why you gave me your full support from the moment I arrived in Hässleholm, but I am more than grateful that you did. You are truly inspirational, combining a high-volume clinical practice with such a vast amount of research projects. I feel privileged, and this thesis is the proof of it, that you gave me the opportunity to work on your studies and that we set up many more together. Numerous trips were necessary but given your hospitality and generosity, I can only regret that I did not go more often.

Emil, ooit kwamen we tot de ontdekking dat een perpetuum mobile (de EKommagneetmotor 1.0) toch wel verdraaid lastig is om te realiseren. Straks staan we voor de 2<sup>de</sup> maal in een pinguïnpak. Wie van de toehoorders van ons profielwerkstuk had dit destijds gedacht? Shaho, wat mooi dat jij het werk in Leiden én in Zweden op fraaie wijze kon voortzetten. Verbluffend snel vond je je eigen weg. Bedankt dat jullie beide mij willen bijstaan om dit traject tot een goed einde te brengen.

Tot slot. Lieve Tijn en Olaf, wat was het makkelijk om afleiding te zoeken van werk met jullie in mijn bijzijn. Ik kan alleen maar hopen dat mijn onverdeelde aandacht nog steeds zo gewenst is als jullie groter en (eigen)wijzer zijn. Allerliefste Iuke, het aantal life-events dat we hebben meegemaakt gedurende dit PhD traject is haast niet bij te houden. Dit proefschrift was dan ook nooit tot stand gekomen zonder jouw steun en vermogen om de juiste balans te

vinden. Bedankt dat je mij geregeld vrij wist te spelen in deze tropenjaren ten behoeve van mijn wetenschappelijke verplichtingen, en, nóg belangrijker, zo af en toe op de rem trapte en liet zien wat nu echt belangrijk is in het leven.

## Curriculum vitae

Koen van Hamersveld was born on the 15<sup>th</sup> 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).