

A novel perspective in total knee arthroplasty

Citation for published version (APA):

Schotanus, M. G. M. (2018). *A novel perspective in total knee arthroplasty: the patient specific instrumentation*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20181116ms>

Document status and date:

Published: 01/01/2018

DOI:

[10.26481/dis.20181116ms](https://doi.org/10.26481/dis.20181116ms)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

Valorisation

Valorisation is a broad concept, and it is the conversion of knowledge into action by allowing parties to share the new knowledge. Proper research naturally shifts the boundaries of our scientific understanding. This scientific expertise, in particular, is a tremendous social and cultural value. However, there is more to the valorisation of expertise. The expertise should be useful not only for the medical professional but also for other stakeholders, whether they are companies, governments or social organisations. This paragraph attempts to discuss the social and economic value of the results described in this thesis.

After the introduction of the modern total condylar prosthesis since the early 1970s, total knee arthroplasty (TKA) changed over time due to science and novel technology.¹ However, more than 45 years later, we still deal with the question how to improve outcomes after TKA. Still 20–30% of the patients are not pain free and/or satisfied after TKA.² It is important to realise that new techniques are making their entry in this digital era. Past decade, three dimensional (3D) printing changed the Health Care. In 2014, the 3D-printing industry grew more than 35% as patents related to knee arthroplasty grow at a faster rate than publications.^{3,4} This suggests that the industry is encouraging innovation, and vigilance in the orthopaedic community is decreasing.⁴

Patient-specific instruments (PSI) are objectively the fastest growing technology in the last 5-years, are currently in a period of exponential growth that began a decade ago. The major new problem of these 3D-printed medical solutions are the high costs. New medical technologies are expensive when they enter the market, and they become cheaper over time, the value of 3D-printing decreases and the technology becomes more accessible, within a reasonable price.⁵ The majority of these 3D-printed medical solutions are still in their experimental stages, but first tests are very promising in a variety of therapeutic areas (e.g. traumatology, cosmetic surgery).

PSI were introduced with the aim to position the TKA more accurately and more efficiently. A concern that arises with any new technique is whether it will achieve a satisfactory outcome for the patient, surgeon, hospital and health-care insurance. The use of PSI has led to new insights. With adequate pre-operative planning, we know in advance which implant size should be used during surgery and how to cope with the difficulties of the revision of a unicompartamental knee arthroplasty (UKA) to TKA, resulting in an acceptable radiographic outcome, component alignment and improved clinical outcomes.⁶⁻⁹ PSI for revision of a UKA-to-TKA makes the operation more accessible for the surgeon but also facilitates the logistics. Though, the major problem of these 3D-printed medical solutions are the high costs.

Thanks to this knowledge society, the next generation of PSIs are almost ready to be introduced. The focus of this equipment is “retro”; instead of an MRI or CT-scan, a full leg X-ray image acquisition in Antero-Posterior (AP) and Lateral (LAT) is the basis for the new PSI. The next step for TKA is the robotic-surgery, making their appearance already in daily practice.

Likewise, as with PSI, the major problem of these “new” robotic solutions is to be the high costs when entering the market.

In summary, valuable information is given regarding PSI for TKA in this thesis. With the introduction of PSI, we are taking a step towards a more personalised and individualised approach to total knee arthroplasty which may also contribute to fewer unhappy knees after TKA.² It is a fact that PSI does the same as the conventional alignment for TKA. When using the PSI, it is advised to use MRI instead of a CT-scan. It is essential to have a personalised approach to the patient and in particular to the patients with a medical history. In case of posttraumatic osteoarthritis with metal near the knee joint, it is advised to use a CT-based PSI. Using the PSI implies that the logistics should be in order and, more importantly, the surgeon should personally approve the preoperative planning and adjust them if desired.

Literature

1. Ranawat CS. History of total knee replacement. *J South Orthop Assoc.* 2002 Winter;11(4):218-26.
2. Michael T. Hirschmann, Henrik Behrend. Functional knee phenotypes: a call for a more personalised and individualised approach to total knee arthroplasty? *Knee Surgery, Sports Traumatology, Arthroscopy* (2018) 26:2873–2874
3. <https://www.forbes.com/forbes/welcome/?toURL=https://www.forbes.com/sites/tjmccue/2015/07/30/4-1-billion-industry-forecast-in-crazy-3d-printing-stock-market/&refURL=&referrer=#/h>
4. Barkun JS, Aronson JK, Feldman LS, et al. Evaluation and stages of surgical innovations. *Lancet* 2009;374:1089.
5. <https://www.sculpteo.com/blog/2017/07/19/how-3d-printing-impacts-the-medical-industry>
6. Kerens B, Boonen B, Schotanus M, Kort N (2013) Patientspecific guide for revision of medial unicongylar knee arthroplasty to total knee arthroplasty. *Acta Orthop* 84(2):165–169
7. Thienpont E, Paternostre F, Pietsch M, Hafez M, Howell S (2013) Total knee arthroplasty with patient-specific instruments improves function and restores limb alignment in patients with extra-articular deformity. *Knee* 20(6):407–411. doi:10.1016/j.knee.2013.07.001
8. M.G.M. Schotanus, E.H. van Haaren, R.P.M. Hendrickx, E.J.P. Jansen, N.P. Kort Accuracy of CT-based patient specific guides for total knee arthroplasty in patients with post-traumatic osteoarthritis and retained metal hardware around the knee joint from previous surgery. *Eur J Orthop Surg Traumatol.* 2015 Dec;25(8):1313-20
9. Martijn GM Schotanus, Elke Thijs, B. Boonen B. Kerens, B. Jong and Nanne P Kort Revision of partial knee to total knee arthroplasty with use of patient specific instruments results in acceptable femoral rotation. *Knee Surg Sports Traumatol Arthrosc.* 2017 Aug 7. doi: 10.1007/s00167-017-4674-8