SEXUAL ACTIVITY AFTER TOTAL HIP AND TOTAL KNEE ARTHROPLASTY

The perspectives of patients, their partners, and orthopaedic surgeons

RITA HARMSEN

Stellingen

behorend bij het proefschrift

Sexual Activity After Total Hip and Total Knee Arthroplasty: The Perspectives of Patients, Their Partners, and Orthopaedic Surgeons

- 1. Als het gaat om genot zijn mannen en vrouwen in hun biologische capaciteit meer gelijk dan verschillend. (*Interview met Ellen Laan door Eva Jinek, uitspraak op 27.20 min https://youtu.be/y0Ie6WSqYgA*)
- 2. Het vasthouden aan het eigen seksuele referentiekader is een sta in de weg voor de professional om seksuele issues te bespreken. (*Woet L. Gianotten, Ned Tijdschr Geneeskd* 2018;162:D2753)
- 3. Artsen hebben de plicht te vragen naar het seksuele leven van een patiënt als daartoe vanuit behandelingsperspectief een concrete aanleiding bestaat. (*Richtlijn Gedragsregels voor artsen; Utrecht: KNMG; 2013*)
- 4. It takes two to tango, toch worden partners van patiënten stelselmatig vergeten bij de opzet van (seksuologisch) onderzoek en in de klinische praktijk. (*Marjan J. Traa, Psycho-oncology 2015 Sep;24(9):1181-8*)
- 5. In vergelijking met recreatieve en sportieve activiteiten werd het preoperatief "samen seks hebben" niet als een beperking ervaren. (*Dit proefschrift, Chapter 5, Part I*)
- 6. Patiënten gingen er blindelings vanuit dat orthopeden het wel vertellen als er risico's zijn bij hervatting van seks na THA of TKA. (*Dit proefschrift, Chapter 5, Part I*)
- 7. Er is binnen de Orthopedische Vereniging geen gouden standaard voor veilige hervatting van seksuele activiteit na THA. (*Dit proefschrift, Chapter 5 Part II en Chapter 6*)
- 8. Vrouwelijke orthopeden en artsen in opleiding tot orthopeed gaven aan dat zij seksualiteit minder vaak bespraken met patiënten dan hun mannelijke collegae. (*Dit proefschrift, Chapter 6*)
- 9. Minder dan één van de vijf patiënten is ontevreden over het resultaat van hun behandeling (THA en/of TKA), echter twee van de vijf patiënten kwamen postoperatief niet uit op hun preoperatieve verwachting van seksuele activiteit. (*Dit proefschrift, Chapter 3 voor THA patiënten; Chapter 4 voor TKA patiënten*).
- 10. Het invullen van een Patient Reported Outcome Measurement (PROM) over de preoperatieve verwachting van seksuele activiteit na THA en TKA is "zinloos", als er geen gesprek op volgt. (*Mancuso et al.*, *J Bone Joint Surg 2001 Jul;83(7):1005-12*)
- "We know enough (about sexual activity after THA); the orthopaedic surgeon should be sensitive enough to start the conversation on sexual activity." (*Editor's Spotlight, Seth S. Leopold, Clin Orthop Relat Res 2016 Feb;474(2):289-92)*
- 12. Onderzoek leidt tot meer onderzoek. Wetenschappelijk onderzoek is in die zin een perpetuum mobile: eenmaal in beweging blijft het uit zichzelf bewegen. (*Rob Nelissen*)

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Rita Harmsen

Colophon

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General Introduction Outline of the Dissertation

General Introduction

Osteoarthritis (OA) is the most common chronic degenerative disease of the musculoskeletal system [1-5]. OA is mainly characterised by structural alterations, such as, degradation of the articular cartilage, osteophyte formation, bone deformation, and inflammatory synovial membrane reaction (Figure 1).

Symptoms of OA (i.e., pain, stiffness, and limited joint motion) may lead to reduced mobility with consequently loss of health-related quality of life [4, 6].



Figure 1: OA bone deformation of hip and knee joints, with narrowed medial joint space, as a result of loss of cartilage and osteophyte formation.

The prevalence of OA is increasing due to an ageing population and increasing obesity in many countries [7]. Worldwide, an estimated more than 240 million people are currently suffering from symptomatic OA including 32 million in the USA [7]. Of every four humans, one develops symptomatic OA in their lifetime and persons aged over 80 have a higher likelihood of symptomatic OA in at least

one knee [8, 9], which is predominantly in the setting of a history of knee injury, obesity, or genetic factors [10, 11]. Studies in Spain and the UK reported a peak in incidence around the age of 75, however, international data are scarce and studies exploring epidemiology are lacking [12, 13].

In The Netherlands, approximately 1.5 million people experience some degree of OA with more women (1,013,900) than men affected (575,000–700,000) [14]. In a period of ten years (2011–2021), the incidence of OA has increased by 250,000 (for men) and 350,000 for women [15]. As a result of OA, the burden on the individual patient is increased because of work loss, loss of income, and premature retirement [15]. However, the burden on society is higher due to associated healthcare cost in high income countries, which accounts for up to 2–5% of the gross domestic product [6].

As there is no cure for OA, it is important to focus on prevention of both, incidence and progression of OA [15, 16]. Occurrence and progression can be influenced by lifestyle interventions and modifications, such as weight loss, muscle strengthening, and exercise [17, 18]. Apart from this, it is important to focus on prevention, by upgrading awareness in society and prevention of juvenile obesity. Research focussing on effectivity of prevention programs and on other possible causes of OA still receives too little attention [19]. Currently, treatment for OA is focussed on pain reduction [16]. If conservative measures for knee OA are ineffective, surgery may be considered [16]. Two surgical modalities exist: joint preserving surgery, for instance osteotomy [20] and (partial) joint replacement.

Joint Replacement

Since the 1960s, joint replacement has revolutionised the orthopaedic health care system [21]. Currently, at present a total 60,000 Total Hip Arthroplasty (THA) and Total Knee Arthroplasty (TKA) surgeries are being performed annually in the Netherlands [22]. The number of revisions has consistently declined in the Netherlands, even during the last decade, with a mean revision rate of THA and TKA of about 5% at 14-year follow-up [22, 23]. Despite these excellent results in the overall THA and TKA population, and despite the enhanced durability of materials inclusive new surgical techniques, the results become less favourable in the under 60 population, where the risk of revision is increasing up to 40%, due to prolonged and heavier load on the prosthesis and its fixation [13, 24, 25]. Overall, total joint arthroplasty is still highly successful, and it is expected that the numbers will grow worldwide [23, 26].

Impact of OA on Sex Life

Symptoms of OA can affect activities of daily life including sexually activity [27–29]. Long-term chronic pain and motion restrictions due to OA may affect the desire for sexual intercourse [28–30]. Consequently, OA may cause tension in the broader (inter) personal relationships of the patient [30, 31], and in particular, may interfere with sexual activity for years until surgery has been performed [29, 30, 32].

Patients' Expectations Regarding Sexual Activity

With the introduction of Patient Reported Outcomes (PROs) around the turn of the millennium, research gradually focused on the issue of patients' expectations of outcomes after hip and knee arthroplasty [33–36]. Most studies aimed to identify factors related to the patients' preoperative expectations and their postoperative fulfilment and/ or examined the extent to which patients are satisfied [37–42]. Furthermore, about 10% of total hip patients and 20% of total knee patients are dissatisfied to some extent about the (overall) result of arthroplasty [25, 42, 43]. Postoperatively, about a quarter of patients do not meet their preoperative expectations [35, 38, 40, 44].

In some studies, it has been showed that the fulfilment of expectation is highly correlated with satisfaction of outcome [40, 45]. In addition, preoperative predictors of satisfaction such as good mental well-being and physical function are recognized as associated factors [42]. However, there is little research on expectations of sexual activity after THA and TKA [38, 40] and outcomes vary widely. In the study of Scott et al., the fulfilment of expected sexual activity for TKA has exceeded [40], whereas, in the study of Tilbury et al., the expectation of postoperative sexual activity was unfulfilled in 15.6% of THA and in 24.8% of TKA [38]. It must be noted that, questions about sexual activity often remain unanswered [38, 40], resulting in response bias, which hampers generalizability.

Addressing Sexual Activity in Consultation Room

The first study was performed in 2004 among orthopaedic surgeons (all members of the American Association of Association of Hip and Knee Surgeons) and examining the surgeons' recommendations on the resumption of sexual activity after THA [46]. Although the response rate of the study was low (30%), the study showed that 80% of surgeons rarely or never addressed sexual issues during consultations. Of the surgeons who discussed sexual activity with patients 96% of them did so in

less than 5 minutes [46]. Subsequent studies also showed that sexual issues were rarely discussed in THA patients [47, 48].

In addition, 20% of the surgeons were aware of at least one incidence of dislocation caused by sex. Regarding the views on how to safely resume sexual activity after THA (i.e., to avoid hip dislocation), Dahm et al. developed drawings of 12 most common sexual positions and presented these positions to the surgeons, to identify at-risk positions. Surgeons (n = 254; 90%) suggested that five out of the twelve sexual positions could be at risk for women and three for men. Surgeons' recommendation on the waiting time to resume sexual activity was 2–3 months [46]. A survey in the UK among orthopaedic surgeons recommended a similar timeframe about resuming sexual activity after THA compared to the study of Dahm [47]. In this study, 30 (36%) surgeons discussed sexual activity if symptoms were interfering with patients' sex lives; 32 (39%) provided written information about sexual activity following THA, and 55 (66%) surgeons believed that patients could safely resume sexual activity after four weeks postoperatively; however, only 21 (25%) surgeons provided this as an appropriated timeframe in communication with patients [47].

Specific Considerations for the Knee

Until now, no study ever has been examining the surgeons' perspectives on sexual activity after knee arthroplasty. In general, the pre- and post-operative impact on sexual activity after TKA from the perspective of patients has been poorly described as well. However, the first retrospective study about sexual activity after TKA (and THA) described that almost all TKA patients (under 60-year) regained sexual activity postoperatively [49]. In addition, this outcome was higher in TKA compared to the THA group. However, more than 10% felt instability and more than 15% limited their frequency of sexual activity due to the artificial knee [49]. Previously, another retrospective TKA study presented first concrete, functional details, such as, the need to adjust sexual positions to accommodate the knee and to avoid bearing weight on the affected knee during sexual activity [50]. Until now, patient education about what to expect about this subject after TKA surgery appears to be inadequate as well.

Is There a Gap in Communication?

Most patients experienced lack of patient information on the subject of postoperative sexual activity. A prospective study reported that while one third of patients reported being inadequately informed preoperatively by the surgeon, the need for information increased to half of the patients who stated being inadequately informed, postoperatively [47]. Most THA studies underscore the importance of providing adequate information to patients [28, 51–53].

During consultation, orthopaedic surgeons may address several aspects of the ICF model (International Classification of Functioning, Disability and Health) [54, 55] to a more or lesser degree, which is essential in managing expectations on outcome after surgery [56]. However, sensitive topics such as sexual activity, are not easily discussed, either in society or in health care [46, 47]. Physicians often feel ill-equipped to discuss the topic [46, 57–59] and patients are reluctant to ask private, intimate-related questions about resumption of sexual activity during consultations [47, 48]. Undoubtedly, the most important questions that patients want to be answered succinctly, are questions about safe sexual positions after surgery and the waiting time before resuming sexual intercourse [48].

Safe Sexual Positions After THA and TKA

Until now, objective research on safe sexual positions is scarce. In 2014, the 'Dahm drawings' were used in a capture motion study conducted in Switzerland [60], and in 2013 Yoon et al. conducted patient reported outcomes and used the same drawings as reference material [61].

The study of Charbonnier et al., aimed to objectively examine the relative risks of total hip dislocation and joint instability by researching the moment of impingement [60]. The twelve sexual intercourse (Dahm) positions were assessed by experiment 3D modelling and performed with two young healthy volunteers/ adults under MRI [60]. Some sexual positions could pose a potential risk for impingement and thus dislocation risk: four positions especially for women, and one position for men [60].

From the patients' perspectives, the South-Korean study of Yoon et al. described that 40% of patients changed their preoperative favourite positions after surgery [48] Forty percent of patients perceived difficulties with the leg positioning [48]. In this study, half of the patients has experienced fear of dislocation [48]. The patients who changed their postoperative sexual positions were unaware that their choices

were in contradiction to the surgeons' advice in current literature [46, 48, 60, 62]. Furthermore, until now objective research on safe sexual positions after THA and TKA is not available. Due to the lack of scientific guidelines, and the fact that patients do not bring up easily questions themselves [58, 59], we expect that the communication in the consultation room will be incomplete and ineffective [47].

Outline of the Dissertation

The aim of this dissertation is to explore patients' and partners' perspectives on topics of sexual activity after THA and TKA (Part I), complemented by orthopaedic surgeon's opinions on safe resumption of sexual activity (Part II).

Definition of the Concept of Sexual Activity

The focus of this dissertation is on the concept of "sexual activity" after hip and knee arthroplasty surgery and is based on patients, partner and surgeons' perspectives. However, humans may view "sexual activity" from a different perspective, like intimate contact, sexual intercourse or sexual positions [62], sexual frequency, etcetera. For that matter, a definition of the concept of sexual activity does not exist.

Part I: Perspectives of Patients and Their Partners

The first part of this dissertation evaluates the perceptions of THA and TKA patients and partners on sexual activity, starting with a systematic review on the effects of THA on the sexual quality of life of patients and partners (**Chapter 2**). Subsequently, the preoperative expectation of sexual activity and their perceived outcomes after surgery in THA patients were examined. In this study (**Chapter 3**), the association between pre- and postoperative functional status and health outcome measures with postoperative sexual activity fulfilment were examined in a large prospective multicentre database: the Longitudinal Leiden Orthopaedics Outcomes of Osteo-Arthritis Study (LOAS). In **Chapter 4** the same research questions were aimed in the TKA LOAS data. In this study, we also focused gender differences and identified prognostic factors for fulfilment of sexual activity.

In **Chapter 5**, we examined the perceptions of sexually active couples; couples who experienced an intention to resume sexual activity after THA or TKA and dared to discuss sexual activity. This article consists of a mixed-method study presenting both, the results of the semi-structured interview with couples, and surgeons' recommendations on safe resumption of sexual activity after THA and TKA. This latter section actually belongs in Part II.

Part II: Perspectives of THA and TKA Surgeons

In the second part, we focused on perceptions of orthopaedic surgeons related to issues of sexual activity and their attitude in addressing and providing information to patients. However, as explained, the results section of the surgeons' recommendations for (safe) resuming of sexual activity after THA and TKA is described in **Chapter 5** (Part I).

In **Chapter 6**, a survey was conducted among the Dutch orthopaedic Hip surgeons evaluating views on sexual activity in regard to OA and THA. This chapter provides opinions about addressing sexual activity in the consultation room.

Part III: Summary and Perspectives

Part III includes the General Discussion (**Chapter 7**), which also provides the implications for clinical practice and future perspectives. **Chapter 8** involves the General Summary.

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Part I

Perspectives of Patients and Their Partners



Chapter 2

Does Total Hip Replacement affect Sexual Quality of Life? A Systematic Literature Review

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Background

Total Hip Replacement (THR) is an effective treatment for end-stage hip osteoarthritis. Since the introduction of total joint replacement, the effect on the Sexual Quality of Life (SQoL) following THR has been addressed in scant studies. The aim of our study was to systematically review the literature, to summarise effects of THR on patients' SQoL.

Methods

We searched PubMed, EMBASE and PsycINFO between January 1970 and February 9th, 2015 with search terms including Total Hip, Osteoarthritis, SQoL, and THR. Eligible studies were identified, and two independent authors extracted data including details of SQoL, study quality and risk of bias.

Results

There were 12 eligible studies, which included a total of 2,099 patients with an age range of 20–85 years. The methodological quality of ten studies was rated as low, and of two as moderate. Amongst the majority of patients, SQoL improved after surgery, both in terms of physical-functional and psychosocial well-being. However, changes between pre-operative and postoperative SQoL ranged extensively: for example, Sexual Dysfunction Δ 8–51% and Sexual Activity (SA) Δ 0–77%. Three studies reported that some patients never resumed SA again after surgery.

Conclusion

In over forty years of THR treatment, scant studies have examined the effect of THR on patients' SQoL. This review suggests that SQol improves after THR, although the magnitude of effects varies highly. However, the quality of the supporting evidence was rated as low to moderate. This suggests a need for more high-quality evidence about the effects of THR on SQoL.

Background

Hip Osteoarthritis (HA) causes pain and affects function, social interactions and Sexual Function (SF) in patients [1, 2]. It has been established that these functions can generally be restored by Total Hip Replacement (THR) [3, 4]. The improvement in surgical techniques and the durability of the implants today have led to a growing number of patients undergoing joint replacement. Consequently, this patient population is growing and becoming both older and younger [5–7].

The effect of THR can – in part – be measured in terms of health-related quality of life [3, 4]. Quality of Life (QoL) is a subjective and multidimensional indicator: it comprises a range of domains including functional ability and physical, emotional and social well-being [8]; it also includes Sexual Quality of Life (SQoL) [9]. The World Health Organization (2006) defines Sexual Health as "a state of physical, emotional, mental and social well-being in relation to sexuality" [10]; hence, it can be said that SQoL is an important part of general well-being, and improvements in SQoL have indeed been associated with improvements in general health related quality of life [10, 11].

As human beings can be sexually active at all ages [12], the total number of sexually active patients undergoing THR will increase. Given the fact that SF is seldom discussed, [12], Sexual Difficulty (SD) might be under-diagnosed in patients with HA; however, while there are some recent international studies into this topic [13–15], an overview of the literature is lacking. The aim of this study, therefore, was to provide a systematic review of the literature, with the aim of summarising the effects of THR on patients' SQoL.

Methods

This systematic review was undertaken in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) system [16].

Data Sources and Searches

We searched electronically in PubMed, EMBASE and PsycINFO (by EBSCO). We also performed a hand search of reference lists of included articles to identify additional relevant studies. The search strategy was developed in collaboration with a medical database specialist (EPJ). The PubMed search strategy, which can

be found in Appendix 1, was adapted for the other databases. The search included articles from January 1970 until February 9th, 2015. The searches included MeSH terms in PubMed, EMtree in EMBASE, thesaurus terms in PsycINFO as well as free text terms. Search terms expressing "total hip" and "osteoarthritis" were used in combination with "sexual quality of life" and "THR" treatment. Search results were imported to a reference manager (Mendeley), and duplicates were removed.

Study Selection

Titles and abstracts were screened using the following eligibility criteria:

- Studies describing SQoL in patients with primary and or secondary HA undergoing THR were included if they measured SQoL after or before *and* after THR; studies that only assessed SQoL before surgery were excluded.
- Homogeneous cohorts of Ankylosing Spondylitis (AS) or Rheumatoid Arthritis (RA) in combination with SQoL were excluded because of the systemic illness and multiple joint involvements interfering with SQoL.
- Studies describing SQoL in patients undergoing THR and Total Knee Replacement (TKR) were excluded if data could not be split up.
- Studies solely assessing expectations about SQoL before and or after surgery were excluded.
- Studies not written in English, German or Dutch were excluded, because of capacity reasons.
- Reviews, editorials, case studies and legal cases were excluded.
- Studies with no full text available through the Dutch Interlibrary Loan System (IBL) were also excluded.

Two reviewers (RH and EPJ) independently applied the eligibility criteria to the titles and abstracts. Where there was uncertainty about eligibility, the full text was examined. Titles and abstracts that were identified as potentially eligible were selected for full-article review. The two reviewers independently screened the full-text articles for final study inclusion. Disagreements would have been resolved by a third author (TH), but this did not occur.

There are no other data found in supplementary files. Al data that support our findings are contained within this manuscript.

Data Extraction

Two reviewers (RH and IS) extracted data from the included studies, independently and into pre-determined forms, and included the patients' demographics, such as disease characteristics, study aims and information about study designs (e.g. sample size, response rate, ages, gender, duration of follow-up, and analysis methods). SQoL outcomes were subsequently extracted and categorised into two dimensions of SQoL: physical-functional well-being and psychosocial well-being. We summarised the data into outcomes quantifying SQoL before and after surgery, as a result of surgery (changes in SQoL) and as postoperative (cross-sectional) outcomes.

Assessment of Methodological Quality

Two reviewers (RH and IS) independently scored the methodological quality of the included studies. Quality was assessed by using 17 of the 23-items quality checklist previously employed by Schouffoer [17] and Tilbury [18]. This checklist is based on Hayden [19] and Shamlyan [20] and is divided into 3 categories: selection bias (items 1–6), information bias (items 7–14), and statistical analysis bias (items 15–17). This quality checklist can be found in Appendix 2. Items concerning multiple determinants were not included.

Risk of bias was considered to be present if one or more of the items within one category were scored as "unclear", "negative" or "not described". When the study represented "high" quality on all items per category, the quality was rated as "0" (absence of risk of bias). When risk of bias was present, or items were not completely or not clearly described, it was rated as "1". The quality of the study was rated as "high" if there was no risk of selection bias, information bias, or statistical analysis bias. The quality was rated as "moderate" if there was evidence of risk of bias in one of the three categories, and as "low" if there was risk of bias in two or all categories.

Data Syntheses

We planned to statistically pool data from studies that were clinically and methodologically homogeneous. However, because of the methodological heterogeneity of the studies, further statistical pooling of data was not possible.

Results

We identified 250 references (88 in PubMed, 159 in EMBASE, 3 in PsycINFO, and 3 additional records by reference checking) and removed 67 duplicates, after which 12 papers met the eligibility criteria for final analysis. The PRISMA flowchart is presented in Figure 1.



Figure 1: Flowchart of the Search and Selection Procedure of the Studies.

Study Characteristics

Studies were published between 1973 and 2014. Four studies were undertaken in North America and Canada, three of which in the USA [15, 21, 22] and one in Canada [4]. Six were undertaken in Europe: two in the UK [23, 24], one in Denmark [25], one in Sweden [3], one in France [26], and one in the Netherlands [27]; two were undertaken in Asia: one in South Korea [13] and one in China/Japan [14].

Seven of the studies were longitudinally designed [3, 4, 14, 21, 24, 25, 27], and five retrospectively [15, 22, 23, 26, 28], comprising a total of 2,099 patients undergoing THR, 60% of which were males and 40% females. Seven of the included studies described SOoL before and or after THR multi-dimensionally, and as the main question [13–15, 22–24, 26]; the other five described SQoL more indirectly, as one of the outcomes of a broader research question [3, 4, 21, 25, 27]. For example, two studies focused on Quality of Life (QoL) after THR [3, 4], one on function and pain after THR [21]; one translated and validated the Oxford Hip Score questionnaire into Dutch [27], and one focused on alternative outcome measures after THR in young patients [25]. The number of participants in the studies ranged from 22 [21] to 791 [15] and their ages from 20 [22] to 86 [21]. Seventeen RA patients (divided into 5 studies) and five AS patients (indicated in 1 study) are present in this review, as they were part of a group of respondents of which the results were not presented separately. The duration of follow-up ranged between the first post-operative routine visit [22] to a mean of 2.3 (+0.8) years after THR [15]. The characteristics of the included studies that assessed SQoL in patients after THR are presented in Table 1.

Methodological Quality

The methodological quality was rated as "moderate" in two studies [14, 15] and "low" in ten studies [3, 4, 13, 21–27]. A full description of the methodological quality of all the studies is shown in Table 2, and the individual scores on all items of the methodological quality assessment can be found in Appendix 3. Unclear study participation, sampling and study attrition caused a risk of selection bias in five studies [13, 21–23, 26]: for example, poor response rates or loss of follow up (more than 30% was considered inappropriate), unrepresentative cohort study populations (e.g. including only satisfied patients) and unclear presented study details about reasons for loss to follow-up.

Inadequate use of validated outcome tools for the measurement of outcomes (inclusive method and setting), and inadequate or incomplete reporting of confounding variables, caused a risk of information bias in eleven studies [3, 4, 13, 15, 21–27]. Three studies were only descriptive [23, 24, 27]. Statistical bias was observed in eleven studies due to unclearly described missing values and a lack of proper statistical analysis (e.g. multivariate analysis methods was considered appropriate) [3, 4, 13, 14, 21–27]. Only one study performed multivariate analysis [15].

First author, author, designMath studyNof patients, (seponse rate)Dignosis nMain inclusionMean age (sens)n(%), wens)Todd 1972Retrospective, colort study interview (int) and interview SurveyInti 123/292 (abin study (int) and (int) and surveyNof patients (seponse rate)Nof patients (seponse rate)Main inclusionMean age (sens)n(%), wate (sens)Todd 1972Retrospective, interview (int) and (int) and SurveyInti and (abin study, survey study, surveyNot (abin) (sev)Mean age (abin)Mean age (sev)Main (sev)WikhundCase-controlTo evaluation of after THR in after THR in study, surveySo(57) (98%)Prim. HA: 40 (19%)Patients with HA (sev)Se(46)S(46)Swedenstudy, Surveygot before and after THR in after THR inSo(57) (98%)Prim. HA: 40 (conset HAPatients with HA (sev)S(30-79)S(46)Swedenstudy, Surveygot before and after THR in study, SurveySo(57) (98%)Prim. HA: 40 (conset HAPatients with HA (conset HAS(30-79)S(46)SwedenSwedenSo(57) (98%)Prim. HA: 40 (conset HAPatients with HA (conset HAS(30-79)S(46)SwedenSurveygot before and after THR and conset HASec. HA: 16 (conset HAS(20-70)S(45)S(45)SwedenSurveySinveySec. HA: 16 (conset HAPatients with (conset HAS(20-70)S(45) </th <th>Table 1: Char:</th> <th>acteristics of the l</th> <th>Included Studies Ass</th> <th>sessing the Effects</th> <th>of THA on SQoL</th> <th></th> <th></th> <th></th> <th></th> <th></th>	Table 1: Char:	acteristics of the l	Included Studies Ass	sessing the Effects	of THA on SQoL					
Todd 1972Retrospective, netwiewIniterviewInterview	First author, country	Study design	Aim/objective	N of patients (response rate)	Diagnosis n (%)	Main inclusion criteria	Mean age (years)	n (%), Male	n (%), Female	Duration of follow up, after surgery
WikhundCase-controlTo evaluation of study, SurveySolo Fore and after THR in Sec. HA: 16Prim. HA: 40Patients with HA Sec. HA: 16Patients with HA Sec. HA: 16C 30, 53 (30-79)21 (38)Swedenafter THR in patients with HASec. HA: 16THR (29%)THR incl 1 RA'<80 year; awaiting sec. HA: 1653 (30-79)21 (38)SwedenRetrospectiveTo determine the solution sudd86/100 (86%)Prim. HA: 74Patients with solution sudd57 (20-70)39 (45)Stern 1991RetrospectiveTo determine the solutions and after THA86/100 (86%)Prim. HA: 74Patients with solution sudd57 (20-70)39 (45)USAcohort study, SF incl. sexualSec. HA: SF incl. sexualPrim. HA: 74Patients with solution sudd57 (20-70)39 (45)USAcohort study, SF incl. sexualRefect of THR on dysplasia and solution suddSec. HA: SF incl. sexualPatients with solution sudd57 (20-70)39 (45)USAProspectiveBolt Patient dysplasia and sube-blindBolt Patient of which 4Refect of THR97 (53)97 (53)UBBProspectiveEffect of THR dysplasia and trial. SurveyPatient suith HA, 664 (40-75)97 (53)UBBProspectiveEffect of THR dysplasia and trial. SurveyPatient suptime dysplasia and dysplasia and 	Todd 1972 UK	Retrospective, cohort study ^d Interview (Int) and Survey	Incidence of SD and influence of THR on SQoL	Int: 123/292 (42%) Surv: 79/134 (58%)	HA^{a}	Patients undergone THR with active sexual relationship at time of onset HA	Interview NA M 61 (30–79) F 60 (29–79)	Interview NA 49 (40) 36 (46)	Interview NA 74 (60) 43 (54)	Int: NA Surv: NA
Stern 1901Retrospective, cohort study, SurveyTo determine the frect of THR on Survey86/100 (86%)Prim. HA: 74Patients with predominantly TH all undergone39 (45)USAcohort study, SurveyFrincl. sexual positions and positions and after THA86%)Prim. HA: 74Patients with predominantly all satisfied about dysplasia and sRAb39 (45)39 (45)LaupacisProspective, double-blindFrincl. sexual positions and after THA12 (14%) all satisfied about dysplasia and <70 y, all satisfied about esults THR57 (20-70)39 (45)LaupacisProspective, double-blindEffect of THR on health related QoL188/251 (75%)HA*Patients with HA, e 75 years, no severe OA of other hip, no previous THR97 (53)LaupacisProspective, trial, SurveyEffect of THR QoL188/251 (75%)HA*Patients with HA, e 75 years, no severe OA of other hip, no previous THR97 (53)	Wiklund 1991 Sweden	Case-control study, Survey	To evaluation of QoL before and after THR in patients with HA	56/57 (98%) ^g	Prim. HA: 40 (71%) Sec. HA: 16 (29%) incl 1 RA ^b	Patients with HA < 80 year; awaiting THR	65 (30–79)	21 (38)	35 (63)	1 year
LaupacisProspective,Effect of THR188/251 (75%)HA ^a Patients with HA,64 (40–75)97 (53)1993double-blindon health related< 75 years, no severe	Stern 1991 USA	Retrospective, cohort study, Survey	To determine the effect of THR on SF incl. sexual positions and resumption SA after THA	86/100 (86%)	Prim. HA: 74 (86%) Sec. HA: 12 (14%) of which 4 dysplasia and 8 RA ^b	Patients with predominantly HA all undergone THR and < 70 y, all satisfied about results THR	57 (20-70)	39 (45)	47 (55)	At time postoperative routine visit
	Laupacis 1993 Canada	Prospective, double-blind randomized trial, Survey	Effect of THR on health related QoL	188/251 (75%)	HAª	Patients with HA, < 75 years, no severe OA of other hip, no previous THR or THR (knee) < 5 years, nor infectious arthritis	64 (40–75)	97 (53)	91 (47)	3 months 6 months ^h 1 year 2 year

FTH Eff th, đ 17.0 ť

Gogia 1994 Prospec USA cohort : Survey		Aim/objective	response rate)	Diagnosis n (%)	Main inclusion criteria	Mean age (years)	n (%), Male	n (%), Female	follow up, after surgery
	ctive study,	Developing evaluation system to assess clinical outcome of THR related to changes in functional status and pain	22/24 (92%)	HAª	Patients with HA, undergoing THR; alert oriented, ambulatory with or without assistive devices	69.2 (57–86)	4 (18)	18 (82)	3 and 6 months ^h
Gosens Prospec 2005 multice The cohort i Netherlands Survey	ctive, antre study,	Translating and validating Oxford Hip Score into Dutch	146/150 (100%)	Prim. HA: 117 (78%) Sec. HA: 33 (22%)	Age > 35 year; patients awaiting THR, No systematic illness and physically and mentally suitable, understanding Dutch language	65 (38-85)	52 (35)	98 (65)	7 weeks, 3 months, 6 months ^h ; 1 year; 2 year
Laffosse Retrosp 2007 cohort : France Survey	pective, study,	SD in patients before and after THR, receiving sufficient information	135/346 (39%)	Prim. HA: 56 (42%) Sec. HA: 76 (58%) Incl. 3 RA ^b	 < 65 year, undergone THR min. 6 months previously; Revision and Femoral Neck Fracture excluded 	51.8 (22-65)	77 (57)	58 (43)	≥ 6 months

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Table 1 continues on next page.

Table 1: Conti	nued								
First author, country	Study design	Aim/objective	N of patients (response rate)	Diagnosis n (%)	Main inclusion criteria	Mean age (years)	n (%), Male	n (%), Female	Duration of follow up, after surgery
Wall 2011 UK	Prospective cohort study, Survey	To determine the effect of HA on SQoL and to assess whether SQoL is considered in surgical plan	86/100 (86%)	Prim. HA: 74 (86%) Sec. HA: 12 (14%) Incl. 3 RA ^b	< 75 year, undergoing THR, living with a partner	62 (48–74)	39 (45)	47 (55)	6 months
Yoon 2013 Korea	Retrospective, cohort study, face-to-face interview	To determine concerns related to SQoL; to determine changes in SA after THR	64/512 (13%)	Prim. HA: 11 (17%) Sec. HA: 53 (83%) Incl. 2 RA ^b , 5 AS ^d	Sexual active patients during previous last year, no dislocation, infection or stiffness	50°	45 (NA)	19 (NA)	≥ 6 months, at routine follow up visit
Wang 2014 Japan	Prospective, multicentre cohort study, Survey	To evaluate the influence of ONFH and THR on SQoL	247/300 (82%)	Sec. HA: all males, ONFH patients (247)	SA married adults, only ONFH males, Age >25-<60. Excluded severe comorbidities	46.8 (34.7– 58.9)	247 (100)		1 year
Nunley 2014 USA	Retrospective multicentre cohort study, Survey	To evaluate SQoL in young active patients following THR	791/806 (98%)°	Prim. and non inflammatory Sec. HAª	 < 60 year; THR and SRA patients, no history postoperative complications UCLA score > 6ⁱ 	49.5 (42.3– 56.7)	531 (66) ⁱ	275 (34) ⁱ	2.3 years (±0.8)
First author, country	Study design	Aim/objective	N of patients (response rate)	Diagnosis n (%)	Main inclusion criteria	Mean age (years)	n (%), Male	n (%), Female	Duration of follow up, after surgery
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Klit 2014 Denmark	Prospective multicentre cohort study, Survey	To explore any –positive or negative – effect THR have had on sexual function, sexual frequency and sexual practice, in younger THR patients	136/153 (89%)	Young HA ^a patients awaiting THR: n = 86) (Hip Resurfacing: n = 44)	 < 60 year, undergoing primary THR/ HR, not suffering from cognitive dysfunction or malignant disease, able to fill in questionnaire 	53 (48–57)	68 (50)	68 (50)	3 months 6 months 1 year ^h
Unspecified n Some RA and Used modern Dstarted with in Mean age deri Mean age deri Comtrol group Duration of fc Duration of fc re-symptome V not correcte	umbers and HA I AS patients werv bearing surfaces nterview, continu ived. ived. a not specified. Ilow up used in 1 atic activity score ed by gender (-15	type. e included because da s: SRA = Surface Repl ued with survey. art lung, liver, kidney art lung, liver, kidney this review. e of University of Cali 5 respondents).	ata could not slit up. acement Arthroplas /s; patients under m ifornia Los Angeles (ity; SRA treatmen edications; psychi (UCLA).	ıt: n = 122 (15%) (181 iatric history; having r	control patients) nental retardatio	. Ė		

Study	Selection bias presentª	Information bias present ^a	Statistical analysis bias presentª	Total bias score	Level of Quality ^b
Todd et al. 1973 [23]	1	1	1	3/3	L
Wiklund et al. 1991 [3]	0	1	1	2/3	L
Stern et al. 1991 [22]	1	1	1	3/3	L
Laupacis et al. 1993 [4]	0	1	1	2/3	L
Gogia et al. 1994 [21]	1	1	1	3/3	L
Gosens et al. 2005 [27]	0	1	1	2/3	L
Laffosse et al. 2007 [26]	1	1	1	3/3	L
Wall et al. 2011 [24]	0	1	1	2/3	L
Yoon et al. 2013 [13]	1	1	1	3/3	L
Wang et al. 2014 [14]	0	0	1	1/3	М
Nunley et al. 2014 [15]	0	1	0	1/3	М
Klit et al. 2014 [25]	0	1	1	3/3	L

Table 2: Methodological Quality Rating of the 12 Included Studies

 $^{a}1 = bias present or unclear; 0 = no bias present; {}^{b}H = high quality: no evidence for selection bias, information bias or statistical analysis bias (not available); M = Moderate Quality: one or two aspects rated as bias present or unclear; L = Low quality: all three aspects rated as bias present or unclear. THR = Total Hip Replacement.$

Outcomes

Studies used a number of terms to describe SQoL, and these terms were categorised into two main-groups, and several subgroups of SQoL:

A. *Physical-functional well-being*, categorised into three sub-groups:

- Sexual Dysfunction (SD),
- Sexual Function (SF), and terms categorised as
- Sexual Activity (SA), for example, "coital frequency", "resuming time of SA", and "hip interfering with SA".

B. Psychosocial well-being of SQoL, categorised into six sub-groups as:

- "Need for information" (or "not able to obtain information"),
- "SD was an argument to undergo THR",
- "Effects on relationship",
- "Effects on sexual satisfaction",
- "Effects on sex quality", and
- "Concerns" (e.g. "concerns from partner", "fear of dislocation", "decreased sexual desire", "arousal difficulty", "loss of libido", and "felt hip slipping out" during SA).

Subsequently, we summarised the differences between pre- and postoperative outcomes in Table 3 as "Changes in SQoL after THR", and the cross-sectional measured postoperative outcomes of SQoL were summarised in Table 4.

Changes in SQoL

Differences between pre- and postoperative outcomes, defined as changes in SQoL after THR (Table 3), were reported in 10 studies [3, 4, 14, 21–27].

Six studies reported a *physical-functional* change in SD after surgery [3, 22, 23, 25–27] which ranged from Δ 25%–51% [3, 22], and by gender between Δ 8%–20% for males and Δ 16%–29% for females [25, 26]. Males preoperatively had less SD than women, women showed greater improvement after THR in three studies [23, 25, 26]. Positive changes between pre-operative and postoperative SA were reported in five studies [4, 14, 21, 24, 25], and ranged widely from Δ 0% to 77% [14, 24]. Two studies reported a change in hip-pain during SA, respectively Δ 53% and Δ 56% [14, 21], while hip-mobility increased in one study (Δ 54%) [14]. Two studies reported positive changes in SA: one reported an increase of "coital frequency" (Δ 73%)[22], and one an improvement in "SA" (Δ 44%) [4]. Two studies reported that the preoperatively sexual active patients had regained SA after THA [24, 25]; both reported a postoperative loss of follow-up (Table 3).

Two studies reported changes in *psychosocial* outcomes of SQoL [14, 24]. One of those, reported an increase in the patients' "need for information" after THR of Δ 28% [24]; the other study (only males) reported reduced "impairment of relationship" (Δ -37%) (p = 0.026) and a change on "sexual satisfaction of patients" of Δ 40% (p = 0.018) [14]. One study assessed associations between pre- and postoperative SQoL and clinical and demographic characteristics, and found no correlation (p > 0.05) between these variables and postoperative SQoL [14].

Postoperative Outcomes of SQoL

Seven studies reported cross-sectional outcomes [13, 15, 22–26] (Table 4); mostly because they were designed retrospectively [13, 15, 22, 23, 26]. *Physical-functional outcomes of SQoL* were extracted from these seven studies [13, 15, 22–26]. SD was reported in one study [23]: 51% females and 50% males had complete to considerable relief of SD after THR. Six studies reported on SF [13, 15, 22, 24–26] including two that reported on increased "coital frequency" [15, 26] in 18.5% and 43.5% of the patients, respectively; coital frequency stayed unchanged in 70% and

52%, respectively, and it decreased in 11.5% and 4.5%, respectively. Four studies reported on the "time to resume SA" [13, 22, 25, 26]: the majority of the patients (> 50%) resumed SA within two months [22, 26]; one Eastern study reported a mean of 6.9 months (3 weeks – 48 months) [13]. Females (87 days) resumed later than males (54 days) (p = 0.0005) [26]. "Decreased SA" was mostly affected by pain, mobility and apprehension [15]. In one study, three patients never resumed SA again [26], and one study reported that 3 males (4%) under 60 years experienced erectile dysfunction after THA [25].

Psychosocial outcomes of well-being were reported in six studies [13, 15, 22–24, 26]. Two studies reported on the need for more advice, ranging from 57%–89% [22, 23]; two reported that 80% of the patients were not able to obtain information [13, 26]; and two studies mentioned SD as an argument to undergo THR [22, 26]. Two studies reported on the terminology subgroups "effect on relationship", "effect on satisfaction", "sex quality" and "concerns" [13, 15]. One study examined "effect on relationship" as the lack of understanding from the spouse (in 4.7%, only males) [13]; in this study, satisfaction increased in 23.4%; stayed the same in 68.8% and decreased in 7.9% [13]. One study found "sex quality" was experienced as better after surgery in 69.9%, and experienced as worse in 2.2% [15]. "Concerns" were quantified in three studies [13, 15, 24]: in one study, 51.6% of patients worried about fear of dislocation [13]; in another, the spouses worried about hurting the partner [24]; a third study reported that 3.1% of the patients felt their hip was slipping out during SA after surgery [15].

Discussion

In this systematic literature review we summarised the effects of THR on SQoL as reported in 12 studies published between January 1970 and early 2015. We found that overall, the majority of studies included in this review saw an improvement in SQoL after surgery for the majority of patients, in terms of both physical-functional and psychosocial well-being. However, the magnitude of this effect varied highly, which may be due to methodological and cultural differences between studies.

The difference between pre-operative and postoperative SD ranged from $\Delta 8\%$ –51% [22, 25], and the difference between pre-operative and postoperative SA ranged even more extensively: $\Delta 0\%$ –77% [14, 24]. This review further suggests that there are differences between men and women and between European/North American

and Asian patients in terms of resuming SA. In addition, four studies reported that the majority of patients (50–80%) did not receive sufficient information about what to expect of SQoL after THR [13, 22–24]. One study reported that the patients' need for information changed after the operation (Δ 28%): the patients would have liked more information after surgery. Another subject of possible misinformation is the time to resume SA again and the fear of hip dislocation after THR [13].

Surprisingly, some studies described SF as an adverse event of THR: one study reported 4% erectile dysfunction in males after THR [25], and two (retrospective) studies reported some patients who never resumed SA again after surgery [15, 26]. This finding was somewhat unexpected; however, we found one additional study that supported this finding [29]. This additional study reported that 26.1% of the males lost the erectile function they had preoperatively, while 6.7% never regained normal erections again after surgery [29]. We did not find evidence for a true association or a causal link between erectile dysfunction and the surgery itself, and the author suggests his findings could be the result of major surgery at a higher age [29].

We found some gender differences in postoperative SA – men resumed sooner than women. We also found geographic differences [22, 26]: the majority of Western (Europe and North America) patients resumed SA within two months, in accordance with recommendations of Western orthopaedic surgeons [24, 30]; the majority of Eastern (Asia) patients resumed after 6.9 months [13]. We found neither recommendations nor additional literature of Asian orthopaedic surgeons. It is possible that discussing sexuality with physicians is a sensitive topic in Asian cultures [13, 31]. However, it has been reported that Western patients do not raise the subject spontaneously either [32]: even surgeons rarely address the issue [30]. Therefore, problems of SQoL in patients undergoing THR could be underdiagnosed in the East and the West alike.

Some studies reported additional comments of patients: two studies reported that in nearly 20% of patients SD was an argument to undergo THR [22, 26]. Four studies mentioned that patients stated they would have welcomed a booklet with additional information [2, 22, 23, 26]. In addition, Currey (1970) suggests that patients want to be adequately informed and prefer to obtain the information from the person with the most knowledge of the pathology [1]. However, it has been described that addressing SQoL is difficult and uncommon for both doctors and patients [33, 34]. We suggest that this lack of communication causes unnecessary concerns: for example, it appears that patients are fearful of hip dislocation after surgery [13].

Table 3: Change	s of SQoL #	After THR									
Study	Quality level	Physical-functional outcomes of SQoL	Psychosocial outcomes of SQoL	n in study	Pre- operative n	Post- operative n	Pre operative % (n) (score)	Post- operative % (n) (score)	Δ SQoL in %	Direction ^c of change	P value
Todd, et al. 1973	ц	SD in Females: None Slight Considerable Intercourse Ended SD in Males: None Slight Considerable Intercourse ended		123	74 49	74 49	39 (29) 12 (9) 16 (12) 32 (24) 61 (30) 16 (8) 8 (4) 14 (7)	59 (44) 15 (11) 5 (4) 20 (15) 76 (37) 12 (6) 0 (0) 12 (6)	20 -11 -12 -12 -8 -8	+ + + + + + + + + + + + + + + + + + + +	
Wiklund, et al. 1991	Г	SD		57	57	56	34	6	-25	+	0.001
Stern, et al. 1991	ц	SD None Slight Severe Extreme SF: Coital Frequency per month		86 ^a	86	83	14 (12) 40 (34) 38 (33) 8 (7) 3.3	65 (54) 34 (28) 1 (1) 0 (0) 5.7	51 - 6 -8 -8 73 ^d	‡ + + + ‡	< 0.001
Laupacis, et al. 1993	Г	SF: decreased SA (score 0–10; with 0 points being the best score)		188	33 ^b	27 ^b	74 (7.4)	30 (3.0)	-44	+++++++++++++++++++++++++++++++++++++++	

PrePost-operative Δ e% (n)% (n)% OLDirection ^c (score)(score)in %of changeP value	47 (2.36) 100 (5) 53 ++	43 (63) 78 (112) 35 + 16 (23) 15 (21) -1 +/- 6 (9) 1 (1) -5 +/- 12 (17) 4 (6) -8 + 23 (33) 3 (4) -20 +	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
Post- operativ n	~	144	8 8	84
Pre- operative n	2	146	135 57	77
n in study	22	150	135 58	2
Psychosocial outcomes of SQoL				
Physical-functional outcomes of SQoL	Pain during SA (score 1–5; with 5 points being the best score)	SD due to hip: Never Sometimes Often Most of time Always	SD: None: Minimal: Moderate: Severe: Extreme: SD: Females None: Minimal:	Moderate: Severe: Extreme: SD: Males None: Minimal: Moderate: Severe: Extreme:
Quality level	Γ	Г	Г	
Study	Gogia, et al. 1994	Gosens, et al. 2005	Laffosse, et al. 2007	

Table 3: Continu	ned										
					Pre-	Post-	Pre operative	Post- operative			
Study	Quality level	Physical-functional outcomes of SQoL	Psychosocial outcomes of SQoL	n in study	operative n	operative n	% (n) (score)	% (n) (score)	SQoL in %	Direction ^c of change	P value
Wall, et al. 2011	Г	Hip Interfering with SA:		86	71	54	77 (55)	0 (0)	-77	+ + +	
			Like more information provided:				55 (39)	83 (45)	28	+	
Wang, et al.	Μ	Effect on:									
2014		SF (scale 0–8; with 0 points being the best score)		247	247	247	29 (2.3)	23 (1.8)	9-	+	0.14
		Hip-pain during SA (scale 0–10; with 0 points being the best score)					65 (6.5)	9 (0.0)	-56	+++++++++++++++++++++++++++++++++++++++	0.009
		Hip-mobility during SA (scale 1–5; with 5 points being the best score)					28 (1.4)	82 (4.1)	54	+++++++++++++++++++++++++++++++++++++++	0.012
			Effect on:								
			Impairment relationship (scale 0–8; with 0 points being the best score)				66 (5.3)	29 (2.3)	-37	+	0.026
			Overall sexual satisfaction patients (scale 1–5; with 5 points being the best score)				54 (2.7)	94 (4.7)	40	‡	0.018

Study	Quality level	Physical-functional outcomes of SQoL	Psychosocial outcomes of SQoL	n in study	Pre- operative n	Post- operative n	Pre operative % (n) (score)	Post- operative % (n) (score)	∆ SQoL in %	Direction ⁶ of change	P value
			Overall sexual satisfaction partner (scale 1–5; with 5 points being the best score)				76 (3.8)	86 (4.3)	10	+	0.4
Klit, et al. 2014	<u>ц</u>	SD due to hip Females (^f OHS scale 0–6; with 6 points being the best score)		136	68	68	67 (4.0)	83 (5.0)	16	+	0.008
		SD due to hip Males (^f OHS scale: 0-6; with 6 points being the best score)			68	68	92 (5.0)	100 (6.0)	8	+	0.102
		SF: SA before and at twelve month follow up ^e		136	108	83	100 (108)	100 (83)	0	-/+	
SD, Sexual Diffu ^a Only satisfied I ^b Patients were a ^c Rating the dire. Positive effect: Negative effect: Unchanged: +/- d Increase 2.4 tin ^e Only CA nation	culty or Sex patients (wit sked to cho. ction of cha + (5–35%); + (-5 to -35 - (between (nes: 2.4/3.3) nes: 2.4/3.3)	ual Dysfunction; SF, Sexual :h results THR). :h results tHR). nge: ++ (35–70%); +++ (> 70%); ++ (35–70%); (> %); (- 35 to -70%); (> %); (- 35 to -70%); (> %); (- 35 to -70%); (> %); (- 36 to -70%); (> %); (> %); (- 36 to -70%); (> %); (- 36 to -70%); (> %); (>	Function; SA, Sexually cted activities (n = 33). ;; .70 %); %).	Active I	oatients.						
f OHS = Oxford the hip).	Hip Score: s	scale 0–6 (score 0 means "du	ie to other reason than	hip"; thi	s was not incl	luded in statis	stics); thus, 1 =	= no sex life al	ble due t	o hip; 6 never	disabled by

Table 4: Postopera	ative Outcomes	of SQoL			
Study	Quality level	Physical -functional outcomes of SQoL (n in study)	Psychosocial outcomes of SQoL (n in study)	Postoperative n (%)	P value
Todd, et al. 1973	Г	Relief SD: Females (n = 32/37)*: Complete Considerable Slight Nil		4 (13%) 12 (38%) 6 (19%) 10 (31%)	
		Relief SD: Males (n = 22/23)** Complete Considerable Slight Nil		6 (27%) 5 (23%) 2 (9%) 9 (41%)	
		(n = 60)	Need for more advice	34 (57%)	
Stern, et al. 1991	Г	SF: Time to resume $(n = 75/86)$: 1-2 months ≤ 1 month ≥ 2 months Females = Males		41 (55%) 8 (11%) 26 (34%) Males sooner	< 0.01
		(n = 64)	Need for more advice	57 (89%)	
			Argument to undergo THR:	15 (20%)	
Laffosse, et al. 2007	Г	SF: Coital Frequency (n = 130/135) Increased Unchanged Decreased		24 (18.5%) 91 (70%) 15 (11.5%)	
		Increased, more women than men			0.02
			Not able to obtain information	110(83%)	
			Argument to undergo THR:	21 (18.5%)	
		SF: Resuming time $(n = 135)$ Females $(n = 58)$ Males $(n = 77)$ Never having resumed again	(n = 77)	66.5 days (4–365) 87 days (4–365) 54 days (5–210) 3 (2%)	0.0005

P value				0.045 #	< 0.01						0.03	tes on next page.
Postoperative n (%)	44 (81%) 9 (17%) 0 0	7/54 (12%)	6.19 months (3wk - 48mo)	25 (39%)	26 (40.6%)	11 (17.2%)	51/62 (80%)	33 (51.6%) 23/45 (51%) 10/19 (53%)	3 (4.7%)	44 (68.8%) 15 (23.4%) 5 (7.9%)	\leq stress = \geq satisfaction	Table 4 continu
Psychosocial outcomes of SQoL (n in study)		Concerns partner: (Fear hurting spouse)					Not able to obtain information	Concerns Fear of dislocations Males Females	Effect on relationship (Males): Lack of understanding spouse	Effect on satisfaction: Same Increase Less	Satisfaction correlated to stress	
Physical -functional outcomes of SQoL (n in study)	Overall effect on SA (n = 53/86): Much better Better No change Worse Much worse		Time to resume SA: $(n = 64/64)$	Difficulty with leg positioning (Females more than Males)	Changing Sexual Positions (more frequently for patients with diff. leg positioning)	Muscle weakness (Males n = 6)						
Quality level	Г		Γ									
Study	Wall, et al. 2011		Yoon, et al. 2013									

lable 4: Continue	pa				
Study	Quality level	Physical -functional outcomes of SQoL (n in study)	Psychosocial outcomes of SQoL (n in study)	Postoperative n (%)	P value
Nunley, et al. 2014	М	SA since surgery $(n = 791)^c$ No Sexual Activity (due to operative hip)		708 (89.5%) 10 (1.3%)	# 0.0061 Odds 1.953
		Sex frequency Less Same More		n = 694 31 (4.5%) 361 (52%) 302 (43.5%)	 # 'less' < 0.0001 < 0.001 00dds 0.130 # 'More' < 0.001 < 00dds 3.422
		If 'more' caused by: Less pain Greater mobility Less apprehension		294 (98%) 288 (95.4%) 224 (74.5%)	
			Sex quality compared to 1 month prior surgery Worse Same Better	n = 697 13 (2.2%) 195 (28%) 487 (69.9%)	# 'Better' < 0.0001 Odds 10.596
			If 'better' caused by: Less pain Greater mobility	481 (98.8%) 458 (94.2%)	
			Less apprehension	310 (64.2%)	
			Concerns at least one episode Felt hip slipping-out during SA (instability)	22 (3.1%)	

P value	# < 0.0016 Odds 3.150					
Postoperative n (%)	81 (11.6%)	55/83 (66%) 10/83 (12%)	12% increase 38% better abilities sexual praxis 84% of them experienced associated increased ROM, decreased pain and fear	No changes	3/68 (4%)	
Psychosocial outcomes of SQoL (n in study)	Had to limit SA due to operation					THR and Control cohort with Odds ratios.
Physical -functional outcomes of SQoL (n in study)		Time to resume SA (n = 136) ≤ 8 weeks > 8 weeks	Sexual frequency: Females	Sexual frequency: Males	Erectile dysfunction: Males	ıl Function; SA, Sexual Activity. on of SA, Quality and Frequency between T
Quality Ievel		Γ				function; SF, Sexua = 'No reply'. = 'No reply'. st year #Comparisc
Study		Klit, et al. 2014				SD, Sexual Dys ^a Adjusted for 5 ^b Adjusted for 1 ^c Within the pa

Dahm, Jacofsky and Lewallen found that 20% of the members of the American Association of Hip and Knee Surgeons reported knowledge of patients experiencing dislocation during SA [30]. However, we found no literature indicating SA as a direct cause of dislocation, nor evidence-based guidelines about safely resuming SA after THR. We did find a recent (2014) motion-capture study that analyses the kinematics of the hip joint during the twelve "most common sexual positions" [35]. This study provides guidance on safe sexual positions, by gender, and describes that sexual positions for women require more hip mobility, and therefore have a higher risk for dislocation. This is confirmed by Lavernia et al. [36]. We suggest that it is a task of orthopaedic surgeons to provide good guidelines, as patients might otherwise try to seek information from the so-called "grey" literature that is available on the Internet. This "grey" information is potentially both inadequate and inaccurate [37].

Comparisons With Other Studies

Our systematic review is, to our knowledge, the first that summarises SQoL after THR. However, we are aware of one recent narrative review that reports the same beneficial but heterogenic effects of THR on SQoL [38], and we found a literature review of RA and sexuality, published in 1999, which reviewed 19 eligible papers with predominantly the same results [39]. Nonetheless, studies into SQoL and surgical hip treatment in the orthopaedic literature are few and far between: The first study was published in 1970, which corresponds to the time that the THR technique was being developed and gradually became safer [1]. However, since then, scant studies have acknowledged SQoL, and of the twelve studies included in this review, five were published more than 20 years ago. Although the methodology of the newer studies (after 2005) is more advanced, and recent studies show more depth of analyses of the topic, the overall results of the studies do not differ essentially between older and more recent studies.

Methodological Implications

We rated ten of the twelve included studies methodologically as "low" because they had numerous sources of risk of bias; and eleven studies lacked multivariate analyses methods. Five of the twelve studies were retrospectively designed, however, in our opinion, these studies were useful for focussing on the study question of SQoL more thoroughly, identifying detailed information and "feasibility issues for future longitudinal research" about SQoL after THR [40]. Generally speaking, we suppose investigating SQoL is complex because it is a sensitive issue. However, Fenton et al. (2001) suggest that sexual behaviour research is as difficult as other areas of self-reported behaviour, including diet, smoking, and alcohol consumption" [41], and they conclude that "continued methodological research is needed to better identify the sources of measurement error." [41].

Additionally, the included studies paid little attention to comorbidities and other potential confounders. For example, a review concerning SQoL in psoriasis patients found that diabetes, hypertension or depression could play an important causal role towards erectile dysfunction [42], and another review suggests that the use of beta-blockers and diuretics may also have negative effects on SF [43]. Given the average age of THR patients, these confounders will likely be present in a considerable part of the hip population. The available studies further paid little attention to gender-specific complaints and outcomes; in addition, whereas females generally outnumber males in THR treatment [7], our review includes 60% males, which indicates selection bias, and this is only partly explained by the fact that one great cohort-study included only men [14].

Strengths and Weakness

Our review was characterized by a number of different – prospectively and retrospectively measured – heterogeneously defined factors of SQoL. This caused marked heterogeneity; consequently, that data synthesis was not possible. Moreover, we may have missed potentially eligible studies in other languages as well as studies on QoL that mention SQoL in the full text only. Although we intended to exclude studies about SQoL in RA and or AS patients (because of the systemic illness and the multiple joint involvements interfering with SQoL), we decided to include 5 studies in which the majority of the patients had OA, but a minority were RA or AS patients (between 2 and 11% of the population). In these studies data were not presented separately for the different diagnosis and therefore the total samples were included in this review. This may have slightly biased the results of our review.

Directions for Further Research

SQoL in patients with HA, before and after THR, is gaining importance as the total number of patients increases and the age range of patients broadens. Given the rising number of patients worldwide, we feel that SQoL should be better quantified routinely, for example by using Patient Reported Outcome Measures (PROMs)

that are validated for this particular purpose. Longitudinal representative cohort studies would be helpful to accurately understand SD, beginning at the early stages, through to end-stage HA and postoperatively after THR.

Conclusion

This systematic review covers scant research of over more than 40 years. The limited number of studies show an overall improvement of SQoL after THR, however with a very large range in the magnitude of the effect. The quality of evidence in the included studies was low to moderate. Our results do indicate that patients have a need for more information, and with the total amount and growing yearly numbers of THR procedures worldwide, it is now clear that more research is warranted to provide information about the effects of THR on SQoL. It is only with this accurate information that we can effectively inform patients about what to expect for their SQoL after THR.

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Appendix

Appendix 1: Search Strategy in PubMed February 9, 2015 (Read from Bottom-Up)

Set	Search terms	Result
#5	#5 NOT ("addresses" [Publication Type] OR "biography" [Publication Type] OR "comment" [Publication Type] OR "directory" [Publication Type] OR "editorial" [Publication Type] OR "festschrift" [Publication Type] OR "interview" [Publication Type] OR "lectures" [Publication Type] OR "legal cases" [Publication Type] OR "legislation" [Publication Type] OR "letter" [Publication Type] OR "news" [Publication Type] OR "letter" [Publication Type] OR "news" [Publication Type] OR "letter" [Publication Type] OR "patient education handout" [Publication Type] OR "popular works" [Publication Type] OR "congresses" [Publication Type] OR "consensus development conference" [Publication Type] OR "consensus development conference, nih" [Publication Type] OR "practice guideline" [Publication Type]) NOT (animals[mh] NOT humans[mh])	88
#5	#3 AND #4	97
#4	"Sexuality"[Mesh] OR "Sexual Behavior"[Mesh] OR "Sexual Dysfunction, Physiological"[Mesh] OR "Sexual Partners"[Mesh] OR sexual*[tiab] OR "sex behavior"[tiab] OR "sex behaviour"[tiab] OR SQOL[tiab]	221,959
#3	#1 OR #2	60,706
#2	"Arthroplasty, Replacement, Hip" [Mesh] OR "Hip Prosthesis" [Mesh] OR (("Arthroplasty" [Mesh:NoExp] OR "Arthroplasty, Replacement" [Mesh:NoExp] OR "Arthrodesis" [Mesh] OR Arthroplasties [tiab] OR Arthroplasty [tiab] OR Arthrodes* [tiab] OR Prosthes* [tiab] OR Implant* [tiab] OR replacement* [tiab] OR revision [tiab] OR Arthrodes* [tiab]) AND ("Hip" [Mesh] OR "Hip Joint" [Mesh] OR Hip [tiab] OR hips [tiab]))	43,562
#1	"Osteoarthritis, Hip" [Mesh] OR "Hip Contracture" [Mesh] OR Coxarthrosis [tiab] OR Coxarthroses [tiab] OR "Femur Head Necrosis" [Mesh] OR Femur Head Necros* [tiab] OR Femur Head osteonecros* [tiab] OR (("Joint Diseases" [Mesh:NoExp] OR "Arthritis" [Mesh:NoExp] OR "Osteoarthritis" [Mesh:NoExp] OR Osteoarthr* [tiab] OR Arthriti* [tiab] OR arthro* [tiab]) AND ("Hip" [Mesh] OR "Hip Joint" TMeshl OR hipftiab] OR hipsftiab]))	41,398

Appendix 2: Checklist Used for the Assessment of the Methodological Quality of the Included Studies

Theoretical background	
1. Is there a theoretical background for the hypothesis?	Used for selection bias
Study participation	
2. Is the study population clearly described in terms of age, gender, and important patients' characteristics?	Used for selection bias
3. Is the percentage of eligible subjects who participated in the study (response rate) adequate? (More than 30% is considered inappropriate)	Used for selection bias
Sampling	
4. Are patients who participated in the study similar to eligible non- participants (the population), in terms of age, gender, and important disease characteristics?	Used for selection bias
Study attrition	
5. Is the percentage of subjects available for analysis adequate? (< 30% not too many missing values or loss to follow-up)?	Used for selection bias
6. Were reasons for loss to follow-up presented and assessed during the study for possible systematic attrition? (Subjects that did not finish the study)	Used for selection bias
Outcome measurement	
Definition of outcome variable(s) 7. Are clear definitions of each outcome variable provided?	Used for information bias
8. Is clear operationalization of each outcome variable provided? How is it measured?	Used for information bias
Measurement of outcome variable(s)9. Are the measurement instruments used for the measurement of the outcome variable(s) reliable and valid?	Used for information bias
Method and setting of the outcome variable(s) 10. Were the measurement approach, time and place of measurement of the outcome variable(s) standardized or conducted in a way that limits systematically different measurement?	Used for information bias
Study confounding	
Definition of potential confounders 11. Are clear definitions of each confounder provided?	Used for information bias

Appendix 2 continues on next page.

Appendix 2: Continued

Study confounding	
12. Is clear operationalization of each confounder provided?	Used for information bias
Measurement of potential confounders 13. Are the measurement instruments used for the measurement of the confounder(s) reliable and valid?	Used for information bias
Method and setting of the confounder(s) 14. Were the measurement approach, time and place of measurement of the confounder(s) standardized or conducted in a way that limits systematically different measurement?	Used for information bias
Statistical analyses	
15. Is the percentage of missing values adequate? Less < 30%	Used for statistical analysis bias
16. Were multivariable analyses performed? Yes is rated as "0"	Used for statistical analysis bias
17. Was it clearly described which variables were included in the (multivariable) model(s)?	Used for statistical analysis bias

Based on Hayden and Shamliyan, and used by Tibury [18, 20].

Item
Per
Study,
per
Assessment
Quality
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Scores of
Individual
3:]
Appendix

																					Total
First author	1	2	3	4	5	9	SubT ^a	7	8	6	10	11	12	13	14	SubT ^b	15	16	17	SubT ^c	score
Todd	0	1	1	1	0	1	4/6=1	0	0	0	1	1	1	1	1	5/8=1	NA	NA	NA	3/3=1	LOW 3/3
Wiklund	0	0	0	0	0	0	0 = 9/0	0	0	0	0	1	1	1	1	4/8=1	0	1	1	2/3=1	LOW 2/3
Stern	0	0	0	г	0	0	1/6=1	0	0	Ч	п	г	1	1	1	6/8=1	0	г	П	2/3=1	LOW 3/3
Laupacis	0	0	0	0	0	0	0 6=0	0	0	0	0	1	1	1	1	4/8=1	0	1	1	2/3=1	LOW 2/3
Gogia	0	0	1	1	0	0	2/6=0	0	0	1	1	1	1	1	1	6/8=1	0	1	1	2/3=1	LOW 3/3
Gosens	0	0	0	0	0	0	0 = 9/0	0	0	0	0	г	1	1	1	4/8=1	NA	NA	NA	3/3 = 1	LOW 2/3
Laffosse	0	0	1	1	1	1	4/6=1	0	0	0	1	1	1	1	1	5/8=1	1	1	1	3/3 = 1	LOW 3/3
Wall	0	0	0	0	0	0	0 = 9/0	0	0	0	0	1	1	1	1	4/8=1	NA	NA	NA	3/3 = 1	LOW 3/3
Yoon	0	0	1	1	0	0	2/6=1	0	0	г	1	1	1	1	1	6/8=1	0	1	1	2/3=1	LOW 3/3
Wang	0	0	0	0	0	0	0 = 9/0	0	0	0	0	0	0	0	0	0/8=0	0	1	1	2/3=1	MED 1/3
Nunley	0	0	0	0	0	0	0 = 9/0	0	0	0	п	0	0	0	1	2/8=1	0	0	0	0/3=0	MED 1/3
Klit	0	0	0	0	0	0	0 = 0/0	0	1	1	0	1	1	1	1	6/8=1	0	1	1	2/3=1	LOW 3/3
SubTotal. ^a Select	ion bia	us, ^b In	format	ion bi	ls, ^c Sti	atistica	l analysis b	ias.													



Chapter 3

Patient Expectations of Sexual Activity After Total Hip Arthroplasty: A Prospective Multicenter Cohort Study

Rita Th. E. Harmsen, Brenda L. den Oudsten, Hein Putter, Claudia S. Leichtenberg (on behalf of the LOAS Study Group), Henk W. Elzevier, Rob G. H. H. Nelissen

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Background

This study aimed to evaluate patients' expectations of postoperative sexual activity (SA) after total hip arthroplasty.

Methods

A prospective multicenter cohort study of 1,271 patients managed with total hip arthroplasty was performed using patient-reported outcome measures of the Longitudinal Leiden Orthopaedics Outcomes of Osteo-Arthritis Study (LOAS). Preoperative SA expectations and their fulfillment after 1 year were assessed with the Hospital for Special Surgery expectations survey. The Hip disability and Osteoarthritis Outcome Score (HOOS) was used to measure functional status, and the Short Form-12 Mental and Physical Component Summary scores (SF-12 MCS and SF-12 PCS) and EuroQol-5 Dimensions (EQ-5D) questionnaire were used to measure health status. Two subgroups were defined preoperatively: the SA-Expecting Group and the No-SA-Expecting Group. The postoperative outcomes with regard to SA (i.e., the difference between postoperative and preoperative SA scores) were classified as "unfulfilled" (score, \leq -1), "fulfilled" (score, 0), or "exceeded" (score, \geq 1). Multivariate regression analyses were used, with t tests to compare means between groups.

Results

In total, 952 (74.9%) patients returned both preoperative and postoperative HSS questionnaires. Preoperatively, 605 patients (63.6%) expected to have postoperative SA. At 1 year, 43.5% of participants reported that this expectation was unfulfilled. In the No-SA-Expecting Group, 18.2% (63 of 347) regained SA, predominantly men. Postoperative SA fulfillment was related to preoperative musculoskeletal (p = 0.001) and non-musculoskeletal comorbidities (p = 0.004) and the postoperative HOOS, SF-12 PCS, SF-12 MCS, EQ-5D, and EQ-5D visual analogue scale (VAS) scores (p < 0.001). Postoperative HOOS-symptoms (odds ratio [OR] 1.04; 95% confidence interval [CI], 1.02 to 1.06; p < 0.001), and HOOS-sport (OR, 1.01; 95% CI, 1.00 to 1.03; p = 0.032) were associated with postoperative SA fulfillment, as was older age (inversely; e.g., \geq 76 years compared with \leq 60 years: OR, 0.28; 95% CI, 0.13 to 0.62; p = 0.002). Correspondingly, for the No-SA-Expecting Group, higher age was also inversely associated with regaining postoperative SA (e.g., \geq 76 years: OR, 0.07; 95% CI, 0.02 to 0.21; p < 0.001).

Conclusion

Of the patients who expected to be sexually active after surgery, 43.5% perceived this expectation to be unfulfilled; 24.3% were still sexually inactive despite most having expected a return to normal SA. Approximately one-fifth of patients who did not expect postoperative SA in fact regained SA. During preoperative consultations, surgeons should pay attention to expectation management surrounding SA.

Level of Evidence Therapeutic level IV.

Background

Sexual activity (SA) is an important part of quality of life at all ages [1, 2]. Osteoarthritis of the hip frequently causes painful limitation of movement [3–10], which can negatively affect SA [4, 10, 11]. One-quarter of patients attributed marital unhappiness and tension in relationships to osteoarthritis [4, 7, 9, 12]. Total hip arthroplasty is an effective treatment [4, 13, 14], and undergoing total hip arthroplasty has been associated with improvement in sexual relations [3–5, 7, 14]. However, fear of hip dislocation [15] and painful physical impairment (e.g., flexion contracture or limited abduction) can limit postoperative SA [16].

Mancuso et al. found that, preoperatively, younger patients, men, and patients living with a partner were more likely to expect improvement in SA [17]. Postoperatively, poor mental health, older age, female sex, living without a partner, and disability were associated with less fulfillment in terms of SA [18–20]. Other studies have focused on the differences between patient and surgeon expectations [21, 22], with surgeons tending to be more optimistic than patients with regard to postoperative SA [21]. Patients often do not ask SA-related questions and surgeons appear not to address SA expectations during consultations [23]. However, as patient preferences for undergoing total hip arthroplasty are a pivotal aspect of surgical decision-making [21], it is important to discuss SA expectations as an outcome of total hip arthroplasty.

As SA has rarely been studied [24], prospective data are needed to better understand sexual function as a measure of outcome following total hip arthroplasty [24]. We are not aware of any previous in-depth studies that have focused on preoperative SA expectations and postoperative SA fulfillment across the total hip arthroplasty population among both younger and older patients of both sexes.

The primary purpose of the present study was to explore the associations between patients' preoperative expectations of SA and their postoperative experience of SA. The second aim was to evaluate which preoperative and postoperative functional status and health outcome measures were associated with postoperative SA fulfillment. The third aim was to perform a multivariate regression analysis to determine which patient characteristics were associated with SA fulfillment.

Materials and Methods

The present prospective multicenter observational cohort study was performed as part of the Longitudinal Leiden Orthopaedics Outcomes of Osteo-Arthritis Study (LOAS) (Trial ID NTR3348), which is embedded in the Dutch Arthroplasty Register (LROI) [25, 26]. The LOAS includes all patients scheduled for primary total hip arthroplasty in 7 participating hospitals: Leiden University Medical Center, Leiden; Alrijne Hospital, Leiden and Leiderdorp (former Diaconessenhuis and Rijnland Hospital); Groene Hart Hospital, Gouda; Reinier de Graaf Hospital, Delft; LangeLand Hospital, Zoetermeer; Albert Schweitzer Hospital, Dordrecht; and Waterland Hospital, Purmerend. Patients were recruited between June 2012 and July 2015. Ethical approval was obtained from the Medical Ethics Committee at Leiden University Medical Center (registration number P12.047). Patients were included in the LOAS [25, 26] once written informed consent was obtained in accordance with the Declaration of Helsinki.

Instruments

Preoperatively, patients were asked to complete a validated Dutch translation of the Hospital for Special Surgery (HSS) questionnaire for total hip arthroplasty [27]. This questionnaire contains 17 value-based items [28]. The present study focused on the HSS item "What do you expect of sexual activity after surgery?" All patients with completed preoperative and postoperative HSS questionnaires were included.

Patient characteristics, including self-reported age, sex, height (cm) and weight (kg) (i.e., body mass index [BMI]), and living status (alone or with children, with a partner with or without children, or "other" [e.g., nursing home]), were collected at baseline. Preoperatively, patients indicated their SA expectations on a 5-point Likert scale: 1 (back to normal [defined as "a return to an expected normal situation"]), 2 (large improvement), 3 (moderate improvement), 4 (slight improvement), and 5 (does not apply to me). At 1 year of follow-up, patients were asked to assess how they perceived the status of their SA using the same 5-point Likert scale. They were not reminded of their preoperative responses at the time of follow-up.

The Hip disability and Osteoarthritis Outcome Score (HOOS) was used to assess hip-related functional status [29]. The Short Form-12 (SF-12) [30], the EuroQoL-5 Dimensions (EQ-5D), and the EQ-5D VAS (visual analog scale) were used to assess general health status [31]. Preoperative comorbidity information was evaluated with use of a Statistics Netherlands questionnaire [32–34], which asks about the presence or absence of comorbidities in the previous year in 2 domains (musculoskeletal and non-musculoskeletal comorbidities).

Statistical Analysis

On the basis of their responses to the SA question, patients were categorized into 2 groups: the SA-Expecting Group (including those with a score of 1 [back to normal] to 4 [slight improvement]) and the No-SA-Expecting Group (including those with a score of 5 [does not apply]). Postoperative fulfillment of SA expectations was calculated by subtracting the postoperative Likert score from the preoperative Likert score. A negative score (\leq -1) indicated less improvement than expected and was categorized as "unfulfilled." A score of 0 indicated an outcome as expected and was labeled as "fulfilled." A positive score (\geq 1) indicated a greater-than-expected improvement and was categorized as "exceeded." The same method was used for the No-SA-Expecting Group. A score of 0 indicated that the outcome was expected (i.e., does not apply) and was labeled as "fulfilled." A score of 21 indicated a greater-than-expected improvement and was categorized as "exceeded." The same method was used for the No-SA-Expecting Group. A score of 0 indicated that the outcome was expected (i.e., does not apply) and was labeled as "fulfilled." A score of 21 indicated a greater-than-expected improvement and was categorized as "exceeded." Indicated a greater-than-expected improvement and was categorized as "exceeded." Indicated a greater-than-expected (i.e., does not apply) and was labeled as "fulfilled." A score of 21 indicated a greater-than-expected improvement and was categorized as "exceeded" (i.e., the patient unexpected) regained SA).

The analyses were stratified according to sex and age (≤ 60 years, 61 to 65 years, 66 to 70 years, 71 to 75 years, and ≥ 76 years). For the functional status and health analyses, postoperative SA outcomes were dichotomized into 2 scales ("unfulfilled" and "fulfilled/exceeded"), with the "fulfilled" and "exceeded" groups combined because the "exceeded" group was very small (n = 53; 8.8%).

The results were analyzed with use of descriptive statistics. In matrices involving 2 categorical variables, the Pearson chi-square test was used to test differences in proportions between groups. In cases in which both categorical variables were ordinal, the Armitage trend test was used. The independent samples t test was used to test differences in the means between the 2 groups.

To assess potential selection bias due to attrition, the baseline characteristics (e.g., age, sex, BMI, living status, comorbidities, and HOOS, SF-12 Physical Component Summary [PCS], SF-12 Mental Component Summary [MCS], and EQ-5D scores) of the included and excluded patients were analyzed and compared with use of the above tests. The same tests were used to analyze associations between preoperative and postoperative scores for functional status and health status as well as for the postoperative achieved fulfillment of SA. Binary logistic regression with

forward Wald selection was used to model the probability of fulfillment for the SA-Expecting Group and the probability of regaining SA for the No-SA-Expecting Group. For the selection of covariates in the multivariate logistic regression, a univariate test was performed on sex, age, BMI, living status, HOOS total score, SF-12 MCS score, SF-12 PCS score, EQ-5D score (including EQ-5D VAS), and non-musculoskeletal and musculoskeletal comorbidities. Covariates were selected for multivariate modeling if the univariate p value was < 0.10. Statistical analyses were performed with use of SPSS (version 22 for Mac/Windows; IBM). The level of significance was set at p < 0.05. Clinical relevance was established with use of minimum clinically important differences (MCIDs) for the SF-12 (MCID = 4.5) [35], EQ-5D (MCID = 0.074) [31], and HOOS items (MCID = 9.1 points) [36].

Results

A total of 1,636 consecutive patients were scheduled for total hip arthroplasty surgery. After screening, 1,271 respondents remained. In total, 1,008 participants (79.3%) answered the preoperative SA question. Incomplete answers on preoperative or postoperative SA were excluded, leaving 952 (74.9%) patients for analysis (Figure 1). Comparisons of data from included and excluded patients showed no statistical differences in terms of patient characteristics and study outcomes measures.

The patients in the No-SA-Expecting group were older (p < 0.001), were more often female (p = 0.001), and had more non-musculoskeletal comorbidities (p = 0.037) compared with those in the SA-Expecting Group (Table 1). Although the No-SA-Expecting Group scored significantly better on HOOS-activities of daily living (p = 0.001), HOOS-pain (p < 0.001), HOOS-quality of life (p < 0.001), HOOS-symptoms (p = 0.012), and EQ-5D (p = 0.018) (Table 1), no clinically important differences were found when these scores were compared with data in the literature on MCIDs in patients undergoing total hip arthroplasty (data not shown) [31, 35, 36].

Most patients expected a return to normal (457 of 605) or a large improvement in SA (87 of 605) (Table 2). The expectation to return to normal was lowest among patients \geq 76 years of age (25.1%; p < 0.001) and was lower among women (42.3%) than men (57.7%). The expectation that SA would not apply after total hip arthroplasty was highest among patients \geq 76 years of age (66.8%) and was higher among women (42%) than men (27.0%) (p < 0.001) (Table 2).



Figure 1: Flowchart of the Study.

Abbreviations: THA: total hip arthroplasty; SA: sexual activity;

The subgroups included 2 subgroups: patients "with" and "without" postoperative expected SA (the SA-expecting" and "SA-No-expecting" groups, respectively).

¹ LOAS exclusion criteria: < 18 years of age, inability to understand Dutch language, physical or mental inability to complete questionnaires, revision surgery, hemiarthroplasty, THA because of tumouror rheumatoid arthritis, or inability or unwillingness to provide informed consent.

² Exclusion criterion: no answer in response to preoperative HSS question on SA expectations.

³ Exclusion criterion: no answer in response to postoperative HSS question on SA fulfillment.

Characteristic	"SA-Expectation" Group	"No-SA-Expectation" Group	P value†
Female sex (no. of patients)	348 (57.5%) of 605	252 (72.6%) of 347	0.001
Age‡ (yr)	65.2±9.2 (n = 605)	72.7±8.2 (n = 347)	< 0.001
Age group (no. of patients)			< 0.001
≤ 60 yr	160 (26.4%) of 605	25 (7.2%) of 347	
61–65 yr	129 (21.3%) of 605	42 (12.1%) of 347	
66-70 yr	147 (24.3%) of 605	61 (17.6%) of 347	
71–75 yr	99 (16.4%) of 605	78 (22.5%) of 347	
> 76 yr	70 (11.6%) of 605	141 (40.6%) of 347	
BMI \ddagger (<i>kg</i> / <i>m</i> ²)	$27.0 \pm 4.3 \ (n = 594)$	$27.2 \pm 4.4 \ (n = 334)$	0.701
Living status (no. of patients)			0.698
Alone or with children	152 (25.5%) of 597	80 (23.3%) of 344	
With partner, with or without children	443 (74.2%) of 597	264 (76.7%) of 344	
Other (e.g., nursing home)	2 (0.3%) of 597	0 (0.0%) of 344	
HOOS‡§			
Activities of daily living	38.5 ± 18.8 (n = 573)	43.3 ± 21.4# (n = 316)	0.001
Pain	36.2 ± 17.6 (n = 585)	$41.9 \pm 20.6 \# (n = 317)$	< 0.001
Quality of life	32.5 ± 10.3 (n = 596)	$35.5 \pm 11.1 \# (n = 341)$	< 0.001
Sport	$17.7 \pm 18.2 \ (n = 581)$	$19.3 \pm 19.6 \ (n = 325)$	0.212
Symptoms	$38.9 \pm 18.0 \ (n = 584)$	$42.2 \pm 19.6 \#$ (n = 314)	0.012
SF-12 MCS‡§	$55.3 \pm 9.4 \ (n = 565)$	54.6 ± 9.5 (n = 310)	0.347
SF-12 PCS‡§	$31.9 \pm 9.5 \ (n = 565)$	32.5 ± 9.8 (n = 310)	0.416
EQ-5D‡§	$0.59 \pm 0.26 \ (n = 596)$	$0.63 \pm 0.24 \#$ (n = 332)	0.018
EQ-5D VAS‡§	66.4 ± 18.2 (n = 563)	67.1 ± 18.8 (n = 315)	0.594
Comorbidities (no. of patients)			
Musculoskeletal "yes"	239 (56.4%) of 424	134 (60.1%) of 223	0.363
Non-musculoskeletal "yes"	351 (67.8%) of 518	211 (74.8%) of 282	0.037

Table 1: Preoperative Patient Characteristics*

* SA = Sexual Activity, BMI = Body Mass Index, HOOS = Hip disability and Osteoarthritis Outcome Score, SF-12 = Short Form-12 Survey, PCS = Physical Component Summary, MCS = Mental Component Summary, EQ-5D = EuroQoL-5 Dimensions (Dutch version), and VAS = visual analog score. † P values for nominal categorical variables calculated with the Pearson chi-square test; for ordinal categorical variables, with the Armitage trend test; and for continuous variables, with the independent t test. ‡ The values are given as the mean and the standard deviation. § All scales ranged from 0 to 100 except the EQ-5D, which ranged from 0 to 1; lower scores indicated worse outcomes. # Clinical relevance was assessed with use of minimum clinically important differences (MCIDs) for the SF-12 (MCID = 4.5) [35], EQ-5D (MCID = 0.074) [31], and HOOS (MCID = 9.1 points) [36]. No MCIDs were found.

67

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\dot{\mathbf{r}} = 66-70 \mathbf{Y} \mathbf{r}$ $1 = (\mathbf{N} = 208)$ $0 = 110 (52 002)$	71-75 Yr (N = 177)					
Preop. expectations of postop. SA* (no. of patients) Back to normal (n = 457) 121 (65.4%) 101 (59.1%) 72 (40.7%) Large improvement (n = 87) 25 (13.5%) 13 (7.6%) 24 (11.5%) 20 (11.3%)	00/ 110 (52 002)		\geq 76 Yr (N = 211)	P value†	Male $(N = 352)$	Female (N = 600)	P value†
Back to normal (n = 457)121 (65.4%)101 (59.1%)110 (52.9%)72 (40.7%)Large improvement (n = 87)25 (13.5%)13 (7.6%)24 (11.5%)20 (11.3%)	0%) 110 (52 0%) 2			< 0.001			< 0.001
Large improvement (n = 87) 25 (13.5%) 13 (7.6%) 24 (11.5%) 20 (11.3%)	/ (0/2.7C) NTT (0/	72 (40.7%)	53 (25.1%)		203 (57.7%)	254 (42.3%)	
	6) 24 (11.5%) 2	20 (11.3%)	5 (2.4%)		31 (8.8%)	56 (9.3%)	
Moderate improvement $(n = 44)$ 10 (5.4%) 13 (7.6%) 11 (5.3%) 6 (3.4%)	6) 11 (5.3%)	6(3.4%)	4(1.9%)		12 (3.4%)	32 (5.3%)	
Slight improvement $(n = 17)$ 4 (2.2%) 2 (1.2%) 2 (1.0%) 1 (0.6%)	0) 2 (1.0%)	1~(0.6%)	8 (3.8%)		11 (3.1%)	6(1.0%)	
SA does not apply $(n = 347)$ 25 (13.5%) 42 (24.6%) 61 (29.3%) 78 (44.1%)	%) 61 (29.3%) 7	78 (44.1%)	141 (66.8%)		95 (27.0%)	252 (42.0%)	

Table 2: Patient Preoperative Expectations Regarding Postoperative Sexual Activity (SA), Per Age Group and Sex

with the Armitage trend test. calculated variables values for orginal calegorica -UII JA. 2000 AS reliected in the

Of the patients with preoperative SA expectations, 47.8% saw their expectation fulfilled after 1 year. In 43.5% of patients, SA expectations were unfulfilled. Of this group, 147 (24.3%) were still sexually inactive despite most having expected a return to normal SA. In contrast, 18.2% of patients who did not expect postoperative SA in fact regained SA (mostly a return to normal SA) (Table 3).

	Fulfill	ment of preop A expectations	erative S*	
	Unfulfilled	Fulfilled	Exceeded	P value†
SA-Expecting Group‡ (n = 605)				
Preoperative SA expectations				0.002
Back to normal $(n = 457)$	187 (40.9%)	270 (59.1%)	0 (0.0%)	
Large improvement $(n = 87)$	44 (51.0%)	9 (10.3%)	34 (39.1%)	
Moderate improvement $(n = 44)$	21 (47.7%)	9 (20.5%)	14 (31.8%)	
Slight improvement $(n = 17)$	11 (64.7%)	1 (5.9%)	5 (29.4%)	
Total $(n = 605)$	263 (43.5%)	289 (47.8%)	53 (8.8%)	
No-SA-Expecting Group (n = 347)		284 (81.8%)	63§ (18.2%)	

* For the SA-Expecting Group, unfulfilled = lower results (≤ 1 step) than expected preoperatively, fulfilled = achieved SA as expected preoperatively, and exceeded = better results (≥ 1 step) than expected preoperatively. For the No-SA Expecting Group, fulfilled = SA not regained postoperatively, and exceeded = SA unexpectedly regained postoperatively. † P value for ordinal categorical variables calculated with the Armitage trend test. ‡ Of the 605 patients in the SA-Expecting Group, 147 had no SA at 1 year postoperatively, including 92 (20.1%) of 457 who had expected to return to normal function, 27 (31.0%) of 87 who had expected large improvement, 17 (38.6%) of 44 who had expected moderate improvement, and 11 (64.7%) of 17 who had expected slight improvement. § Of the 63 patients in the No-SA-Expecting group who unexpectedly regained SA, 53 (84.1%) regained normal function, 4 (6.3%) reported large improvement, and 3 (4.8%) reported slight improvement, and 3 (4.8%) reported slight improvement.

In the SA-Expecting group, unfulfilled SA expectations increased with higher age (e.g., SA expectations were unfulfilled for 36.3% of patients \leq 60 years old, compared with 61.4% of those \geq 76 years old). SA expectations were exceeded for nearly 10% of patients in all age groups, with the exception of those > 76 years old (with SA expectations being exceeded for only 2.9% of patients) (see Appendix).

In the No-SA-Expecting Group, the proportion of patients who regained SA decreased with higher age, from 60% (15 of 25) among patients \leq 60 years old to 7.1% (10 of 141) among those \geq 76 years old. Overall, among patients \leq 60 years old, we found an interaction with sex (men, p = 0.007; women, p = 0.048), with men being more likely to unexpectedly regain SA (38.9%; 37 of 95) than women (10.3%; 26 of 252) (see Appendix).

		0									
	Preope health par postopera e	rative function ameters accor itive achievem xpectations	nal/ ding to ent of	Postoper health para postoperat ex	rative functio meters accor tive achievem pectations	nal/ ding to tent of	Change be	etween preope paran	erative and neters†	postope	rative
Functional and health status	Unfulfilled‡	Fulfilled/ exceeded‡	P value§	Unfulfilled‡	Fulfilled/ exceeded‡	P value§	Unfulfilled‡	Fulfilled/ exceeded‡	P value§	∆ t	Relative o MCID#
SA-Expecting Group Comorbidities (no. of patients)											
Musculoskeletal (n = 239/424)	109 (45.6%)	130 (54.4%)	0.001	NA	NA		NA	NA	NA	NA	
Non-musculoskeletal (n = 351/518) HOOS**	161 (45.9%)	190 (54.1%)	0.004	NA	NA		NA	NA	NA	NA	
Activities of daily living (scale 0-100)	36.5 ± 20.0	39.9 ± 17.7	0.031	75.8 ± 21.8	91.9 ± 11.0	< 0.001	39.3 ± 23.6	52.0 ± 19.2	< 0.001	12.7	+
Pain (scale 0–100)	34.5 ± 19.0	37.4 ± 16.5	0.048	79.9 ± 22.0	92.6 ± 11.7	< 0.001	45.4 ± 23.6	55.2 ± 19.2	< 0.001	9.8	-/+
Quality of life (scale 0–100)	31.9 ± 11.0	33.0 ± 9.7	0.195	52.1 ± 18.3	63.5 ± 13.0	< 0.001	20.2 ± 18.3	30.5 ± 14.8	< 0.001	10.3	‡ +
Sport (scale 0–100)	15.2 ± 17.6	19.3 ± 18.2	0.008	54.7 ± 29.0	76.7 ± 20.7	< 0.001	39.5 ± 28.0	57.4 ± 25.1	< 0.001	17.9	+++++
Symptoms (scale 0–100) Health status**	37.0 ± 17.6	40.3 ± 18.2	0.031	70.9 ± 22.2	86.9 ± 13.5	< 0.001	33.8 ± 23.0	46.6 ± 21.4	< 0.001	12.7	‡
SF-12 PCS (scale 0–100)	30.7 ± 9.5	33.2 ± 9.6	0.003	42.0 ± 11.1	49.7 ± 8.7	< 0.001	11.4 ± 10.1	16.3 ± 10.9	< 0.001	4.9	+
SF-12 MCS (scale 0–100)	53.7 ± 10.2	56.4 ± 8.6	0.001	54.1 ± 9.4	57.2 ± 5.9	< 0.001	0.2 ± 10.6	0.9 ± 8.7	0.420	0.7	Ι
EQ-5D (scale 0–1)	0.56 ± 0.27	0.62 ± 0.24	0.005	0.78 ± 0.21	0.91 ± 0.13	< 0.001	0.23 ± 0.28	0.30 ± 0.24	0.002	0.07	-/+
EQ-5D-06 (VAS scale 0–100)	63.7 ± 18.6	68.5 ± 17.7	0.002	74.4 ± 14.0	83.0 ± 11.2	< 0.001	10.8 ± 19.3	14.3 ± 17.3	0.026	3.5	NA

Table 4: Functional and Health Status and Change According to Fulfillment of SA Expectations (After 1 Year)*
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Functional and health status	Fulfilled‡	Exceeded‡	P value§	Fulfilled‡	Exceeded‡	P value§	Fulfilled‡	Exceeded‡	P value§	Δ	to MCID#
No-SA-expecting group Comorbidities (no. of patients)											
Musculoskeletal (n = 134/223)	116 (86.6%)	18 (13.4%)	0.019	NA	NA		NA	NA	NA	NA	
Non-musculoskeletal (n = 211/281) HOOS**	173 (82.0%)	38 (18.0%)	0.403	NA	NA		NA	NA	NA	NA	
Activities of daily living (scale 0–100)	42.3 ± 20.6	48.9 ± 23.3	0.028	79.2 ± 20.1	89.7 ± 15.1	< 0.001	36.9 ± 23.1	40.8 ± 22.4	0.232	3.9	I
Pain (scale 0–100)	40.6 ± 20.1	48.0 ± 21.1	0.011	86.1 ± 18.6	91.9 ± 14.4	0.023	45.5 ± 24.3	43.9 ± 21.3	0.637	-1.6	Ι
Quality of life (scale 0–100)	34.8 ± 11.2	38.6 ± 10.3	0.014	58.3 ± 17.9	64.1 ± 15.6	0.018	23.5 ± 19.2	25.5 ± 16.3	0.442	2.0	I
Sport (scale 0–100)	18.8 ± 19.6	22.6 ± 20.0	0.177	56.3 ± 29.1	74.4 ± 22.9	< 0.001	37.6 ± 30.6	51.8 ± 24.5	0.001	14.2	+
Symptoms (scale 0–100)	41.4 ± 19.2	45.5 ± 20.9	0.148	75.8 ± 20.8	86.4 ± 18.1	< 0.001	34.4 ± 24.6	40.9 ± 23.3	0.062	6.5	-/+
Health status**											
SF-12 PCS (scale 0–100)	31.7 ± 9.5	35.9 ± 11.6	0.006	42.9 ± 12.0	49.6 ± 9.3	< 0.001	11.6 ± 11.2	14.1 ± 11.6	0.146	2.5	I
SF-12 MCS (scale 0–100)	54.4 ± 9.5	57.2 ± 7.9	0.045	54.7 ± 8.7	56.6 ± 6.4	0.144	0.23 ± 10.2	-0.63 ± 7.6	0.561	-0.86	Ι
EQ-5D (scale 0–1)	0.62 ± 0.25	0.67 ± 0.21	0.211	0.81 ± 0.20	0.90 ± 0.15	0.001	0.19 ± 0.25	0.23 ± 0.21	0.188	0.04	Ι
EQ-5D06 (VAS scale 0–100)	66.9 ± 18.5	69.7 ± 19.9	0.300	75.1 ± 16.8	83.9 ± 12.2	<0.001	7.8 ± 17.0	13.9 ± 17.2	0.017	6.1	NA
* SA = sexual activity, MCID = r SF-12 = Short Form-12, PCS = Pl	ninimum clinic hysical Compo	ally important nent Summary	difference, MCS = Me	NA = postope ntal Compone	rative data no nt Summary,	t available, EQ-5D and	HOOS = Hip EQ-5D = Eur	disability and oQoL 5-Dime	Osteoarthr nsions scal	itis Out es (Dute	come Score, ch versions),
and VAS = visual analog scale. \dagger (= lower results (\leq 1 step) than ex	Change: the diff spected preope	ference betwee ratively, fulfille	n preoperati d = achieve	ve and postope d SA as expect	erative scores; ed preoperati	higher scor vely, exceed	es = better out ed = better re	tcome. \ddagger For S sults (≥ 1 step	A-Expectin) than expe	g Groul cted pr	o, unfulfilled eoperatively.
For No-SA-Expecting Group, ful	filled = SA not	regained posto	peratively, a	nd exceeded =	SA unexpecte	edly regaine	d postoperativ	ely. §P values	for ordinal	categori	cal variables
calculated with Armitage trend to	est; p values for	continuous vai	riables calcu	lated with inde	spendent sam]	ples t test. #	++ indicates >	 10 above MC 	ID norm; +	/- indi	cates slightly

under MCID norm, - indicates under MCID norm, and - indicates well below MCID norm. ** The values are given as the mean and the standard deviation.

Joint-specific functional scores (HOOS) and overall quality-of-life scores were lower among all patients with unfulfilled SA expectations compared with patients in the SA fulfilled/exceeded group, except for HOOS-pain in the No-SA-Expecting group (Table 4). Preoperative musculoskeletal comorbidities were strongly associated with postoperative fulfillment (p = 0.001), as were non-musculoskeletal comorbidities (p = 0.004). As for the difference between preoperative and postoperative scores, the postoperative changes of almost all scores (HOOS domain subscores, SF-12 PCS, and EQ-5D) were greater in the group that exceeded expectations compared with the MCIDs reported in the literature [31, 35, 36] (Table 4).

Table 5: Associations With Postoperative SA Fulfillment of Both Subgroups (Multivariate Analysis)*

Variables associated with SA fulfillment	Odds Ratio (95% CI)	$\beta \pm SE$	P value
SA-Expecting Group			
Constant		-2.84 ± 0.60	
Preoperative musculoskeletal comorbidities "yes"	0.69 (0.43-1.10)	-0.38 ± 0.24	0.12
Age groups			0.005
≤ 60 yr	1.0		
61–65 yr	0.98 (0.50-1.93)	-0.022 ± 0.35	0.951
66-70 yr	0.89 (0.47-1.70)	-0.11 ± 0.33	0.728
71–75 yr	0.43 (0.21-0.87)	-0.85 ± 0.36	0.018
≥ 76 yr	0.28 (0.13-0.62)	-1.26 ± 0.40	0.002
Postoperative HOOS-symptoms (scale	1.04 (1.02–1.06)	0.037 ± 0.009	< 0.001
0–100†), per unit increase			
Postoperative HOOS-sport (scale 0–100†), per unit increase	1.01 (1.00–1.03)	0.013 ± 0.006	0.032
No-SA-Expecting Group			
Constant		-1.29 ± 0.62	
Age groups			< 0.001
≤ 60 yr	1.0		
61–65 yr	0.31 (0.10-0.93)	-1.19 ± 0.57	0.037
66–70 yr	0.16 (0.06-0.46)	-1.84 ± 0.54	0.001
71–75 yr	0.20 (0.07-0.54)	-1.64 ± 0.52	0.002
≥ 76 yr	0.07 (0.02-0.21)	-2.64 ± 0.55	< 0.001
Postoperative HOOS-sport (scale 0–100†), per unit increase	1.02 (1.01–1.03)	0.023 ± 0.006	< 0.001

* SA = Sexual Activity, CI = Confidence Interval, β = beta regression coefficient, SE = Standard Error, and HOOS = Hip disability and Osteoarthritis Outcome Score. † Higher score = better outcome.

Older age was inversely associated with postoperative fulfillment of SA expectations (e.g., patients \geq 76 years of age versus \leq 60 years of age, odds ratio and 95% confidence interval [OR and 95% CI] = 0.28 [0.13 to 0.62]; p = 0.002) (Table 5). The probability of postoperative SA fulfillment was only slightly associated (4% per unit increase) with a higher (better) postoperative score for HOOS-symptoms (OR = 1.04 [1.02 to 1.06]; p < 0.001) and HOOS-sport (OR = 1.01 [1.00 to 1.03]; p = 0.032). In the No-SA-Expecting group, better postoperative HOOS-sport scores were weakly associated with a higher probability of SA fulfillment (OR = 1.02 [1.01 to 1.03]; p < 0.001). Older age decreased the likelihood of regaining SA (e.g., patients \geq 76 years of age versus \leq 60 years of age, OR = 0.07 [0.02 to 0.21]; p < 0.001). Given the high percentage of fulfillment, the ORs in these results do not have a relative risk interpretation.

Discussion

One year after total hip arthroplasty, expectations regarding SA were unfulfilled in 43.5% of patients who had expected to regain SA. Of the patients without SA expectations, 18.2% reported postoperative SA, with the highest rates (approximately 60%) in patients \leq 60 years of age and male patients.

Previous studies evaluating SA expectations demonstrated that 15% to 50% of patients had unfulfilled SA expectations at the time of the 1-year follow-up [19, 20]. Poor mental health, older age, female sex, and physical disabilities have been found to be associated with decreased postoperative SA fulfillment [17, 20, 21, 37]. Although previous studies had a smaller sample size, had more missing data (35% to 40%), and were more heavily skewed toward men and younger patients than our LOAS cohort study, the present study also demonstrated these findings. However, we stratified the patients into 2 subgroups: patients with and without expectations of postoperative SA. The fact that none of the other studies has classified participants in this way makes comparison impossible, especially for the achieved postoperative SA of the patients in the No-SA-Expecting Group.

Important confounders for decreased SA are older age and pain [2]. The importance of sexuality in older people was highlighted in a longitudinal (4-generation) cohort study in Sweden, which demonstrated that the frequency of SA among the population of individuals \geq 70 years of age has increased since the turn of the millennium [38]. We suggest that SA is an important aspect of quality of life [24] and warrants attention given that sexuality is not regularly addressed in orthopaedic consultations [5, 15, 23, 39]. Reported outcomes and patient expectations of postoperative outcomes are mainly determined by information provided by professionals [21, 22]. Overall, about 25% of all patients managed with total hip arthroplasty are unsatisfied with the postoperative results [19]. The dissatisfaction may be associated with the absence of SA, which, in a considerable part of this group, may be reflected in patient-reported outcome measures associated with functionality.

In a retrospective telephone-call follow-up study among young (\leq 60-year-old) patients managed with total hip arthroplasty, 95% of patients were found to have regained postoperative SA and 70% reported a better quality of sex life [14]. The follow-up period in that study was 2.3 years; the duration of follow-up in the present study was only 1 year. Recent literature, however, has shown that patients' greatest objective functional improvement after total hip arthroplasty occurs in the first 3 months [37]. Other literature has shown that patients expect to be fully recovered at 6 months after total hip arthroplasty [40]. Consequently, there is a gap between our results (42.3% unfulfilled SA after 1 year) and the patients' expected fully recovered horizon of 6 months; this gap is concerning, particularly as unfulfilled SA after surgery may cause distress41. Consequently, it underlines the importance of addressing SA expectation management in the consultation room, not only for younger patients, but also for the population of patients \geq 70 years of age [38, 42]. Our results after 1 year provide useful additional information for arthroplasty surgeons and add to the current literature.

The present study had 3 main strengths. First, it is a large multicenter prospective cohort study, with patient-reported outcome measures on joint-specific and quality-of-life domains, focusing on the sexual functioning of patients at all ages and of both sexes (rather than just men). Second, this study provides complete data on SA outcomes both before and after surgery (with postoperative Likert scores being subtracted from preoperative scores). Third, the response rate for the present study was very high (74.9%), probably because the "sensitive" question on SA was asked alongside other questions on expectations of postoperative outcomes (e.g., activities of daily living, recreation, and sport), with the same answer options.

The present study also had some limitations. First, some patients may have found the SA answer options to be under-defined, although we suggest that most patients likely interpreted the option "back to normal" as a "return to preoperative levels," as it was intended (i.e., a return to what the patients consider to be normal for them). Second, this study is based on patients' (subjective) perspectives on the topic of SA, but so too are most studies on patient-reported outcomes. Third, the HSS questionnaire was primarily developed and validated for preoperative use in the United States [17, 28]; it was later validated for use worldwide [43, 44], including for preoperative and postoperative use in the Netherlands [27]. As with other translated and validated questionnaires, there may be some interpretation difficulties and thus issues with external validity, construct validity, and generalizability. The HSS questionnaire provides reliable information on functional status, which aids in clinical evaluation. However, as SA is multidimensional [24, 45], further methodologically rigorous research is necessary to thoroughly investigate sexual issues in patients undergoing total hip arthroplasty.

Two-thirds of the total hip arthroplasty population studied here had an expectation of postoperative SA. Of the 605 patients who expected to engage in SA after surgery, 43.5% reported that those expectations were unfulfilled and 24.3% were still sexually inactive at 1 year despite having expected a return to normal SA. In contrast, nearly 20% of patients who did not expect postoperative SA in fact regained SA. A return to normal SA was more common among patients who were younger and who were in the No-SA-Expecting group. Older age was associated with a lower likelihood of regaining SA and of postoperative SA fulfillment. Patients with unfulfilled postoperative SA expectations might have had unrealistic expectations at the preoperative stage. Clinicians should consider taking SA into account as a primary outcome of total hip arthroplasty and should inform patients (particularly older patients) to develop realistic expectations regarding postoperative sexual functioning.

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Appendix

Tables showing (1) postoperative SA outcomes according to preoperative patients expectations by age and sex and (2) the interaction between age group and sex are available with the online version of this article as a data supplement at jbjs.org (http://links.lww.com/JBJSOA/A66).

		Posto	perative perc	eived outcor	ne*	
	SA-1	Expecting Gro	up† (N = 605)		No-SA-E) Group† ()	xpecting N = 347)
Preoperative expectations	Unfulfilled	Fulfilled	Exceeded	P value‡	Fulfilled	Exceeded
Age						
< 60 yr						
SA-Expecting Group						
Total $(n = 160)$	58 (36.2%)	86 (53.8%)	$16\ (10.0\%)$	0.001		
Back to normal $(n = 121)$	41 (33.9%)	80 (66.1%)	0 (0.0%)			
Large improvement $(n = 25)$	14~(56.0%)	3 (12.0%)	8 (32.0%)			
Moderate improvement $(n = 10)$	1(10.0%)	3 (30.0%)	6~(60.0%)			
Slight improvement $(n = 4)$	2 (50.0%)	(%0.0)0	2 (50.0%)			
No-SA-Expecting Group (SA does not apply) $(n = 25)$ ‡					10~(40.0%)	15~(60.0%)
61–65 yr						
SA-Expecting Group						
Total $(n = 129)$	57 (44.2%)	63~(48.8%)	9 (7.0%)	0.346		
Back to normal $(n = 101)$	41 (40.6%)	60 (59.4%)	0 (0.0%)			
Large improvement $(n = 13)$	8 (61.5%)	(%0.0) 0	5 (38.5%)			
Moderate improvement $(n = 13)$	7 (53.8%)	2 (15.4%)	4(30.8%)			
Slight improvement $(n = 2)$	1(50.0%)	1(50.0%)	0 (0.0%)			
No-SA-Expecting Group (SA does not apply) $(n = 42)$					32 (76.2%)	10 (23.8%)
66–70 yr						
SA-Expecting Group						
Total $(n = 147)$	57 (38.8%)	74 (50.3%)	$16\ (10.9\%)$	0.111		

Chapter 3

		POSU	operative perc	erved outco	me*	
	SA-	Expecting Gro	up† (N = 605)		No-SA-E Group† (xpecting N = 347)
coperative expectations	Unfulfilled	Fulfilled	Exceeded	P value‡	Fulfilled	Exceeded
Back to normal (n = 110)	40 (36.4%)	70 (63.6%)	0 (0.0%)			
Large improvement $(n = 24)$	9 (37.5%)	2 (8.3%)	13 (54.2%)			
Moderate improvement $(n = 11)$	7 (63.6%)	2 (18.2%)	2 (18.2%)			
Slight improvement $(n = 2)$	1(50.0%)	0 (0.0%)	1 (50.0%)			
No-SA-Expecting Group (SA does not apply) $(n = 61)$;					48 (78.7%)	13 (21.3%)
71–75 yr						
SA-Expecting Group						
Total $(n = 99)$	48 (48.5%)	41(41.4%)	10(10.1%)	0.200		
Back to normal $(n = 72)$	34 (47.2%)	38 (52.8%)	0 (0.0%)			
Large improvement $(n = 20)$	9 (45.0%)	3 (15.0%)	8~(40.0%)			
Moderate improvement $(n = 6)$	4 (66.7%)	0 (0.0%)	2 (33.3%)			
Slight improvement $(n = 1)$	1(100%)	0 (0.0%)	0 (0.0%)			
No-SA-Expecting Group (SA does not apply) $(n = 78)$;					63~(80.8%)	15 (19.2%)
≥76 yr						
SA-Expecting Group						
Total $(n = 70)$	43~(61.4%)	25 (35.7%)	2 (2.9%)	0.724		
Back to normal $(n = 53)$	31 (58.5%)	22 (41.5%)	0 (0.0%)			
Large improvement $(n = 5)$	4(80.0%)	1 (20.0%)	0 (0.0%)			
Moderate improvement $(n = 4)$	2 (50.0%)	2 (50.0%)	0 (0.0%)			
Slight improvement $(n = 8)$	6 (75.0%)	0 (0.0%)	2 (25.0%)			
No-SA-Expecting Group (SA does not apply) $(n = 141)$					131 (92.9%)	10 (7.1%)

		Poste	operative perc	eived outco	me*	
	SA-	Expecting Gro	oup† (N = 605)		No-SA-E Group† (xpecting N = 347)
Preoperative expectations	Unfulfilled	Fulfilled	Exceeded	P value‡	Fulfilled	Exceeded
Sex						
Female						
SA-Expecting Group						
Total $(n = 348)$	170(48.9%)	148(42.5%)	30 (8.6%)	0.058		
Back to normal $(n = 254)$	116(45.7%)	138 (54.3%)	0 (0.0%)			
Large improvement $(n = 56)$	32 (57.1%)	5 (8.9%)	19 (33.9%)			
Moderate improvement $(n = 32)$	17 (53.1%)	5(15.6%)	10 (31.3%)			
Slight improvement $(n = 6)$	5 (83.3%)	0 (0.0%)	1 (16.7%)			
No-SA-Expecting Group (SA does not apply) ($n = 252$)#					226 (89.7%)	26 (10.3%)
Male						
SA-Expecting Group						
Total $(n = 257)$	93 (36.2%)	141 (54.9%)	23 (8.9%)	0.005		
Back to normal $(n = 203)$	71 (35.0%)	132 (65.0%)	0 (0.0%)			
Large improvement $(n = 31)$	12 (38.7%)	4(12.9%)	15(48.4%)			
Moderate improvement $(n = 12)$	4 (33.3%)	4 (33.3%)	4 (33.3%)			
Slight improvement $(n = 11)$	6 (54.5%)	1 (9.1%)	4(36.4%)			
No-SA-Expecting Group (SA does not apply) $(n = 95)$					58 (61.1%)	37 (38.9%)
* The values are given as the number of patients, with the percenta than expected preoperatively, fulfilled = achieved SA as expected the No-SA-Expecting orom $fulfilled = SA$ not regained motomera	ge in parenthese preoperatively, o tivelv and exceed	s.† For the SA exceeded = bet ded = SA unexr	-Expecting Gr ter results (2 Decredly regain	oup, unfulfi 1 step) than ed nostoner	lled = lower re expected prec ativelv ± P val	sults (≤ 1 step) peratively; for ues for ordinal
categorical variables calculated with Armitage trend test.			<u>a</u>	n Loope Lang		

			Male					Female		
		Postopera	ttive perceiv	ed outcome			Postoper	ative perceiv	red outcome	
Preoperative expectations	Total No.	Unfulfilled†	Fulfilled†	Exceeded†	P value‡	Total No.	Unfulfilled†	Fulfilled†	Exceeded†	P value‡
≤ 60 yr SA-Expecting Group										
Total	65	19 (29.2%)	37 (56.9%)	9 (13.8%)	0.007	95	39~(41.1%)	49 (51.6%)	7 (7.4%)	0.048
Back to normal	49	13 (26.5%)	36 (73.5%)	(%0.0) 0		72	28 (38.9%)	44 (61.1%)	(%0) 0	
Large improvement	10	5 (50.0%)	(%0) 0	5(50.0%)		15	9 (60.0%)	3 (20.0%)	3 (20.0%)	
Moderate improvement	ю	(%0) 0	1 (33.3%)	2 (66.7%)		~	1 (14.3%)	2 (28.6%)	4 (57.1%)	
Slight improvement	б	1 (33.3%)	(%0) 0	2 (66.7%)		-	1(100%)	(%0) 0	(%0) 0	
SA-Not-Expecting Group	17		5 (29.4%)	12 (70.6%)		8		5 (62.5%)	3 (37.5%)	
(SA does not apply)										
61–65 yr										
SA-Expecting Group										
Total	52	16 (30.8%)	34 (65.4%)	2 (3.8%)	0.218	77	41 (53.2%)	29 (37.7%)	7 (9.1%)	0.495
Back to normal	46	14(30.4%)	32 (69.6%)	(%0) 0		55	27 (49.1%)	28 (50.9%)	(%0) 0	
Large improvement	2	1(50.0%)	(%0) 0	1 (50.0%)		11	7 (63.6%)	(%0) 0	4 (36.4%)	
Moderate improvement	б	1(33.3%)	1 (33.3%)	1(33.3%)		10	6 (60.0%)	1(10.0%)	3 (30.0%)	
Slight improvement	1	(%0) 0	1(100%)	(%0) 0		Ч	1(100%)	(%0) 0	(%0) 0	
SA-Not-Expecting Group	11		5(45.5%)	6 (54.5%)		31		27 (87.1%)	4(12.9%)	
(SA does not apply)										

Table E-2: Interaction Between Age Groups and Sex for Postoperative Outcomes *

			Male					Female		
		Postopera	tive perceive	ed outcome			Postopera	ative perceiv	ed outcome	
Preoperative expectations	Total No.	Unfulfilled †	Fulfilled†	Exceeded†	P value‡	Total No.	Unfulfilled†	Fulfilled†	Exceeded†	P value‡
66–70 yr SA-Expecting Group										
Total	51	16 (31.4%)	29 (56.9%)	$6\ (11.8\%)$	0.081	96	41 (42.7%)	45 (46.9%)	10~(10.4%)	0.450
Back to normal	39	12 (30.8%)	27 (69.2%)	(%0) 0		71	28 (39.4%)	43 (60.6%)	(%0) 0	
Large improvement	8	2 (25.0%)	1 (12.5%)	5 (62.5%)		16	7 (43.8%)1	1 (6.3%)	8 (50.0%)	
Moderate improvement	б	2 (66.7%)	1 (33.3%)	(%0) 0		8	5 (62.5%)	1 (12.5%)	2 (25.0%)	
Slight improvement	1	0 (0%) ((%0) 0	1(100%)		1	1(100%)	(%0) 0	(%0) 0	
SA-Not-Expecting Group	13		6(46.2%)	7 (53.8%)		48		42 (87.5%)	6 (12.5%)	
(SA does not apply)										
71-75 yr										
SA-Expecting Group										
Total	48	18 (37.5%)	25 (52.1%)	5(10.4%)	0.164	51	30 (58.8%)	16 (31.4%)	5 (9.8%)	0.472
Back to normal	37	14 (37.8%)	23 (62.2%)	(%0) 0		35	20 (57.1%)	15 (42.9%)	(%0) 0	
Large improvement	6	3 (33.3%)	2 (22.2%)	4(44.4%)		11	6 (54.5%)	1(9.1%)	4(36.4%)	
Moderate improvement	1	0 (0%)	0 (0%)	1(100%)		S	4(80.0%)	(%0) 0	1(20.0%)	
Slight improvement	1	1(100%)	(%0) 0	(%0) 0		0	(%0) 0	(%0) 0	(%0) 0	
SA-Not-Expecting Group	18		10(55.6%)	8(44.4%)		60		53 (88.3%)	7 (11.7%)	
(SA does not apply)										

			Male					Female		
		Postoperat	tive perceive	ed outcome			Postopera	ttive perceiv	ed outcome	
Preoperative expectations	Total No.	Unfulfilled†	Fulfilled†	Exceeded†	P value‡	Total No.	Unfulfilled†	Fulfilled†	Exceeded†	P value‡
≥ 76 yr										
SA-Expecting Group										
Total	41	24 (58.5%)	16 (39.0%)	1(2.4%)	0.592	29	19 (65.5%)	9(31.0%)	1(3.4%)	0.524
Back to normal	32	18 (56.3%)	$14 \ (43.8\%)$	(%0) 0		21	13 (61.9%)	8 (38.1%)	(%0) 0	
Large improvement	7	1 (50.0%)	1(50.0%)	(%0) 0		Э	3 (100%)	(%0) 0	(%0) 0	
Moderate improvement	2	1 (50.0%)	1(50.0%)	(%0) 0		2	1 (50.0%)	1 (50.0%)	(%0) 0	
Slight improvement	5	4 (80.0%)	(%0) 0	1 (20.0%)		б	2 (66.7%)	(%0) 0	1 (33.3%)	
SA-Not-Expecting Group (SA does not apply)	36		32 (88.9%)	4(11.1%)		105		99 (94.3%)	6 (5.7%)	
*The values are given as the number than expected preoperatively, fulfille, the No-SA-Expecting group, fulfilled categorical variables calculated with A	of patie id = ach = SA n Armitag	ints, with the pe lieved SA as ex ot regained pos certered te	ercentage in pected preol stoperatively	parentheses. peratively, ex and exceede	† For the S treeded = t td = SA une	A-Expe oetter re xpected	cting Group, 1 sults (≥ 1 ster Ily regained po	unfulfilled =) than expe ostoperative	lower result: cted preoper ly. ‡ P values	s (≤ 1 step) atively; for for ordinal



Chapter 4

A High Proportion of Patients Have Unfulfilled Sexual Expectations After TKA: A Prospective Study

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Background

Most patients have high expectations about restoration of the knee function after TKA, expecting a more active life after retirement. However, 20% to 30% of patients report that their expectations are not met postoperatively. Among those unmet expectations may be the anticipation to engage in sexual activity after surgery, but few studies have evaluated sexual activity after arthroplasty.

Questions/Purposes

In this study, our purposes were (1) to evaluate the anticipation and the fulfillment of sexual activity after TKA in men and women, and (2) to identify prognostic factors for the fulfillment of anticipated postoperative sexual activity.

Methods

This was a prospective, multicenter study of all 1,371 patients scheduled for TKA between June 2012 and July 2015. The study was part of the Longitudinal Leiden Orthopaedics Outcomes of Osteoarthritis Study (LOAS). After screening according to LOAS inclusion criteria, 1,213 respondents remained. Our primary study endpoint was whether sexual expectations were met one year after TKA; we used the sexual-activity-expectation question from the Hospital for Special Surgery Knee Replacement Expectations Survey (HSS), which allows the patient to score the result on a 5-point scale. To assess postoperative fulfillment of sexual activity one year after TKA, we asked the patient to score the current status of sexual activity on the same 5-point scale: 1 (back to normal), 2 (large improvement), 3 (moderate improvement), 4 (slight improvement), and 5 (does not apply). Patients with incomplete data on the preoperative expectation- and postoperative fulfillment-question of sexual activity were excluded, leaving 71% (866 of 1,213) patients for analysis. The difference between the pre- and postoperative scores determined whether expectations of sexual activity were unfulfilled (lower than expected) or fulfilled/exceeded (neutral or higher than expected). Pre- and postoperatively, the Knee Injury and Osteoarthritis Outcome Score (KOOS), the Short Form-12 Mental and Physical Component Summary scores (SF-12 MCS and SF-12 PCS), the EuroQoL-5 Dimensions (EQ-5D), and the EQ-5D VAS scale were used. Multivariate regression analysis was used for analysis.

Results

Preoperatively, 54% patients (467 of 866) anticipated postoperative sexual activity after recovery from surgery. Both genders showed that the propor-

tion who anticipated "back to normal" sexual activity decreased with higher age. Likewise, postoperative fulfillment of anticipated sexual activity was found in 58% (111/191 for men; 159/276 for women). Younger women (younger than 65 years of age) experienced fulfillment more often compared with younger men. A positive postoperative change in functional and health status was associated with fulfilled/exceeded scores of patients anticipating postoperative sexual activity. A better preoperative health status, the EQ-5D VAS score (odds ratio [OR] 1.02 [95% CI 1.01 to 1.03]; p = 0.006), was associated with a higher likelihood of fulfillment of anticipated postoperative sexual activity.

Conclusion

In both men and women, two out of five patients anticipating postoperative sexual activity indicated that their expectation of sexual activity was not met 1 year after TKA. These patients had worse functional recovery scores compared to patients who achieved the anticipated level of sexual activity. The latter is associated with functional recovery. Surgeons should be aware that many patients anticipate restoration of normal sexual activity, and that this may be the expectation for patients of all ages and for women and men alike. The results underscore the need for more qualitative research to understand this topic in greater depth.

Level of Evidence

Level II, therapeutic study.

Introduction

Sexual activity is an important aspect of quality of life during all ages [3, 33, 53]. Older patients today expect to remain active, and this includes sexual activity [37], but their ability to do so may be seriously limited by osteoarthritis [27]. Although TKA improves knee pain for many patients and implant durability is generally good [8, 9, 37], as many as 20% of patients have persistent limitations after recovery [9, 30, 37, 48].

Patients' expectations about functional restoration of the knee after TKA are high [34], but they go unmet in 20% to 30% of patients [47, 48, 52]. Among those unmet expectations is the expectation to engage in sexual activity after surgery [36, 43, 47]. Despite the importance of sexual activity for men and women, few studies have evaluated this topic, which is so important for an individual's quality of life [27, 39, 40]. In 45% of patients, sexual activity was limited because of the knee [27], and 44% of the TKA population rated improvement of postoperative sexual activity as important [28, 36, 52]. However, it is not common for surgeons and patients to discuss this topic during a preoperative consultation [19, 27, 29, 50], even though patients expect surgeons to address the issue of sexual activity as it relates to knee complaints [27, 46].

We therefore sought (1) to evaluate the anticipation and the fulfillment of sexual activity after TKA in men and women, and (2) to identify prognostic factors for the fulfillment of anticipated postoperative sexual activity.

Patients and Methods

Study Design

This was a prospective, multicenter study of primary TKA patients. The study was part of the Longitudinal Leiden Orthopaedics Outcomes of Osteoarthritis Study (LOAS) [31, 45]. The LOAS study is an ongoing multicenter, longitudinal, prospective cohort study designed to determine long-term Patient Reported Outcomes (PROs) in THA and TKA (Trial ID NTR3348).

Setting

In the present study, we considered as potentially eligible all patients scheduled for primary TKA recruited in seven participating hospitals [31, 45], which were all located in the urban Randstad region of the Netherlands. Participating hospitals

included five general hospitals (each around 300 beds), one university (882 beds) and one teaching hospital (around 500 beds).

Participants

Patients were eligible for the study if they were diagnosed with primary knee OA and scheduled for TKA. We excluded patients who were younger than 18 years of age, who did not understand the Dutch language, who were physically or mentally unable to complete questionnaires, who were undergoing revision surgery, hemiarthroplasty, TKA because of tumouror rheumatoid arthritis, and those with the inability or unwillingness to provide informed consent [31]. Eligible patients were informed about the study through written and oral information by their treating medical specialist at the outpatient clinic. Only patients who agreed to be approached by the researcher received additional written information about the study by regular mail, as well as a questionnaire, a stamped return envelope, and an informed consent form. Patients who did not return their preoperative questionnaire within 1 week were contacted by telephone [31]. Patients were included once written informed consent was obtained according to the Declaration of Helsinki. For this analysis, we only included data from patients who had completed the item on sexual activity in both pre- and postoperative questionnaires. Ethical approval was granted by the Medial Ethics Committee of the Leiden University Medical Center (LUMC, registration number P12.047).

Between June 2012 and July 2015, a total of 1,371 patients were scheduled for TKA. After screening on LOAS inclusion criteria, 1,213 were enrolled in the LOAS study. In total, 1,138 participants (94%) completed the preoperative Hospital for Special Surgery (HSS) Knee Replacement Expectations Survey item on sexual activity. Patients with postoperative incomplete sexual activity data were excluded, leaving 71% (866 of 1,213) patients for analysis (Figure 1). Postoperative follow-up was carried out approximately 1 year after TKA (median 397 days; interquartile range 380 to 421 days).

Data comparison of included and excluded patients showed no differences in terms of patients' characteristics. With regard to functional and health status, we found some differences in 5 out of 11 variables. On these items, included patients showed slightly better results compared to excluded patients: respectively mean \pm SD, for KOOS pain, 39 \pm 18 compared to 36 \pm 19; p = 0.028; KOOS ADL, 45 \pm 18 compared to 43 \pm 20; p = 0.039; for SF12 MCS, 56 \pm 9 compared to 54 \pm 10; p = 0.003; for EQ5D, 0.65 \pm 24 compared to 0.60 \pm 26; p = 0.001, and for EQ5D-VAS, 69 \pm 17 compared to 64 \pm 19; p < 0.001.



Figure 1: Flowchart of the Study.

The study included two subgroups: Patients Anticipating (and Not Anticipating) Postoperative Sexual Activity.

^a LOAS exclusion criteria: younger than 18 years of age, inability to understand Dutch language, physical or mental inability to complete questionnaires, revision surgery, hemiarthroplasty, TKA because of tumour or rheumatoid arthritis, or inability or unwillingness to provide informed consent.

^b Exclusion: no answer in response to preoperative and/or postoperative HSS question on sexual activity.

Assessments

Sociodemographic Characteristics

Preoperatively, we collected patient characteristics, including self-reported age, gender, weight (kg) and height (m) to calculate the BMI. Living status was collected as: partner "yes" or "no", "unknown"/ "missing."

Comorbidities

Preoperative comorbidity information was gathered by self-report, based on standardized items developed and used by Statistics Netherlands [10, 11], asking for the presence or absence of 19 different comorbidities in the previous year, which were categorized in two domains: musculoskeletal or non-musculoskeletal comorbidities. Comorbidities were summed within each of these categories and dichotomized as follows: presence (one or more comorbidity within this domain) or absence (no comorbidities within the domains) [32, 42]. Musculoskeletal comorbidities were severe back pain (including slipped disc); severe neck or shoulder pain; severe elbow, wrist or hand pain; and, other chronic rheumatic diseases. Non-musculoskeletal comorbidities were asthma or chronic obstructive pulmonary disease; severe cardiac disorder or coronary disease; arteriosclerosis (abdomen or legs); hypertension; the consequences of stroke; severe bowel disorder; diabetes mellitus; migraine; psoriasis; chronic eczema; cancer; urinary incontinence; sensory impairments: hearing impairments during group and face-to-face conversation; short- and long-distance vision impairments; dizziness in combination with falling. Data were gathered at baseline.

Functional Status and Health Status

To assess knee-related functional status, we used the Knee Injury and Osteoarthritis Outcome Score (KOOS; scale 0 to 100), and its sub-domains: KOOS Activities of Daily Living (ADL); KOOS Pain; KOOS Quality of Life (QoL); KOOS Sport; KOOS Symptoms [6]. To assess health status, we used the Short Form-12 Mental and Physical Component Summary (SF-12 MCS and SF-12 PCS, scale 0 to 100) [12, 23], the EuroQoL-5 Dimensions (EQ-5D, scale 0 to 1), and the EQ-5D VAS (scale 0 to 100) [51]. For all functional and health status scores, higher scores indicate better functioning or less pain. Data were gathered at baseline and follow-up.

Preoperative Expectation of Sexual Activity

Our primary study endpoint was whether sexual expectations were met one year after TKA. We used a single question from the validated Dutch translation [1] of the Hospital for Special Surgery Knee Replacement Expectation Survey (HSS) [35, 55]: the expectation of sexual activity after surgery, which allows the patient to score the result on a 5-point scale: 1 (back to normal), 2 (large improvement), 3 (moderate improvement), 4 (slight improvement), and 5 (this expectation does not apply to me) [1]. In the analysis of preoperative data, answers to this item were categorized into two subgroups: those who before surgery who anticipated sexual activity after TKA (score 1 to 4), and those with score 5 who did not anticipate sexual activity (choosing the answer "does not apply"). Only the data of patients who anticipated sexual activity (score 1 to 4) were used for analysis of postoperative fulfillment of anticipated sexual activity.

Postoperative Fulfillment of Expectation of Sexual Activity

The study endpoint was whether expectations were met regarding anticipated sexual activity 1 year after TKA. To measure expectation fulfillment, the (preoperative) HSS questionnaire was modified for use in longitudinal LOAS research. This postoperative equivalent of the (preoperative) HSS questionnaire was based on the same 17 items and was composed of the same 5-point scale. Only the heading of the questionnaire was changed: asking the patient to report the "actual status" of the 17 function/activities (such as, sexual activity). Patients were not reminded of their preoperative responses.

We calculated "fulfillment of anticipated postoperative sexual activity" by subtracting the postoperative score (the current status regarding sexual activity) from the preoperative anticipated score of sexual activity. A negative score (\leq -1) indicated less improvement than expected and was categorized as "unfulfilled." A neutral score (0) and a "greater than expected" score (\geq 1) indicated a score as predicted or that expectations were exceeded. The latter two categories were collapsed and labeled "fulfilled/exceeded."

Statistical Analyses

We analyzed and stratified the data to gender and in four age groups: ≤ 60 years, 61 to 65 years, 66 to 70 years, ≥ 71 years. To assess potential selection bias due to attrition, we compared the following baseline characteristics: age, sex, BMI, living

status, comorbidities, all KOOS (total) domains, SF-12 PCS and SF-12 MCS) of the included and excluded patients.

To address our first research purpose, we evaluated differences in baseline characteristics in patients anticipating and not anticipating postoperative sexual activity (Table 1). Armitage's trend test was used for ordinal categorical variables and Pearson's chi-square test for nominal categorical variables. We evaluated anticipated postoperative sexual activity by age groups and gender (Table 2).

Pearson's chi-square test (categorical variables), and independent samples t-test (continuous variables) were used to evaluate whether patients with fulfilled anticipations on postoperative sexual activity have different preoperative characteristics for age, gender, baseline functional status, baseline health status and comorbidity status) compared with patients with unfulfilled expectations (Table 3).

To assess whether fulfillment of the anticipated postoperative sexual activity was associated with changes in postoperative functional and health status, we used the Armitage's trend test for ordinal categorical variables and the independent sample t test for continuous variables. To assess clinical relevance, we used the minimal clinical important differences (MCID); we used MCID 9.1 points for KOOS (total) domains [44]; MCID 4.5 points for SF-12 MCS and PCS [5, 12], and MCID 0.074 points for EQ-5D [51] (Table 4).

To address our second research purpose, we evaluated prognostic factors for the fulfillment of anticipated postoperative sexual activity using a binary logistic regression analysis with backward Wald selection (Table 5). Age (as a continuous variable) and gender were included in the models, irrespective of statistical significance. For the selection of covariates for the multivariate logistic regression, we performed a univariate test for BMI, living status, all (preoperative) KOOS (total) domains, the SF-12 MCS, the SF-12 PCS, and the EQ-5D scores, including EQ-5D VAS. We selected covariates for multivariate modeling if the univariate p value was less than 0.10 [49]. The level of significance for removing variables in the backward selection in the multivariate analyses was set at p < 0.05.

Statistical analyses were performed with SPSS Statistics version 24 for Windows/ Mac (IBM Corp, Armonk, NY, USA).

Results

Anticipation of Sexual Activity After TKA and Fulfillment of Expectations

What Are the Differences in the Baseline Characteristics Between Patients Anticipating and Not Anticipating Postoperative Sexual Activity?

Overall, few differences were found between the patients who anticipated in engaging postoperative sexual activity (54%, 866 of 467) and the patients who did not (46%, 399 of 866). The group who anticipated postoperative sexual activity consisted of younger respondents and fewer females [age 65 years \pm 8 and 59%, (276 of 467) women] compared with the group who did not anticipate sexual activity (age 70.0 years \pm 8 and 75%, [298 of 399] women). Living status, BMI, and baseline functional and health status scores were similar between both groups, except that those with less pain (higher KOOS pain score) were more likely to expect post-operative sexual activity. This group also reported 10% less non-musculoskeletal comorbidities (70%, 279 of 398), compared to those not anticipating postoperative sexual activity (81%, 255 of 315; p = 0.001) (Table 1).

In terms of gender, men more often had expectations regarding postoperative sexual activity: 35% (101/292) compared to 52% (298/574) of women were expecting "does not apply", p < 0.001 (Table 2). And, in all age groups, more men expected a "back to normal" sexual activity after surgery, with the highest number in patients who were \leq 60 years old; for men, 60% (33 of 55), p = 0.004 and for women, 47% (58 of 124), p < 0.001. Both genders showed that anticipating "back to normal" sexual activity slightly decreased with higher age (Table 2).

Which Patient Characteristics are Related to Fulfillment?

We did not find differences between the genders in terms of fulfilled expectations regarding sexual activity. Forty-two percent of men 42% (80 of 191) and 42% women (117 of 276) did not have their expectations met; 58% of men (111 of 191) and 58% of women (159 of 276) said that their expectations were fulfilled. Fulfillment of anticipation was slightly less frequently achieved in higher age groups. Patients with fulfilled/exceeded expectations had better baseline function and health status scores compared with those with unfulfilled anticipation, respectively mean (\pm SD): for KOOS ADL, 44 \pm 19 versus 47 \pm 17; p = 0.019; for SF12-MCS, 54 \pm 10 versus 57 \pm 8; p = 0.006; and for EQ5D VAS, 67 \pm 16 versus 71 \pm 17; p = 0.026. Of the patients with musculoskeletal comorbidities, more

	Patients anticipating postoperative sexual	Patients not anticipating postoperative sexual	
Patient characteristics	activity $(n = 467)$	activity (n = 399)	P value ^a
Gender (number of women)	59% (n = 276)	75% (n = 298)	< 0.001
Age (years) (range 39–93 years) ^a	65 (± 8)	70 (± 8)	< 0.001
Age groups (number of patients)			
\leq 60 years (n = 179)	27% (n = 127)	13% (n = 52)	< 0.001
61–65 years (n = 162)	22% (n = 102)	15% (n = 60)	
65–70 years (n = 207)	23% (n = 108)	25% (n = 99)	
\geq 71 years (n = 318)	28% (n = 130)	47% (n = 188)	
BMI (kg/m ²) ^a	29 (5) (n = 465)	29 (5) (n = 393)	0.701
Partner (number of patients)			
No	26% (n = 122)	25% (n = 99)	0.820
Yes	73% (n = 342)	75% (n = 298)	
Unknown or missing	1% (n = 3)	1% (n = 2)	
Functional Status Scores			
KOOS-Total domains ^{b,c}			
Activities of Daily Living	$44 \pm 18 (n = 422)$	$46 \pm 17 (n = 366)$	0.161
Pain	$37 \pm 17 (n = 417)$	41 ± 19 (n = 359)	0.002
Quality of Life	$33 \pm 10 \ (n = 462)$	$35 \pm 11 \ (n = 398)$	0.095
Sport	$10 \pm 13 \ (n = 447)$	$12 \pm 15 (n = 377)$	0.235
Symptoms	$44 \pm 13 (n = 419)$	$44 \pm 14 (n = 360)$	0.947
Health Status scores			
SF12 MCS ^{b,c}	$56 \pm 9 (n = 437)$	$56 \pm 9 \ (n = 358)$	0.729
SF12 PCS ^{b,c}	$32 \pm 9 (n = 437)$	$33 \pm 9 (n = 358)$	0.380
EQ-5D ^{b,c}	$0.7 \pm 0.2 \ (n = 452)$	$0.7 \pm 0.2 \ (n = 382)$	0.898
EQ-5D VAS ^{b,c}	$69 \pm 17 (n = 428)$	$69 \pm 18 \ (n = 360)$	0.720
Comorbidity (number of patients)			
Musculoskeletal	50% (n = 302)	55% (n = 245)	0.206
Non-musculoskeletal	70% (n = 398)	81% (n = 315)	0.001

Table 1: Preoperative Patient Characteristics

^a P value: nominal categorical variables were calculated with the Pearson chi-square test; ordinal categorical variables, with the Armitage trend test; continuous variables, with the independent t-test. ^b Data are presented as the mean ± SD.

^c All scales ranged from 0 to 100 except the EQ-5D, which ranged from 0 to 1; higher scores indicated better outcomes.

Clinical relevance was assessed by using minimum clinically important differences (MCIDs) for the SF-12 (MCID = 4.5) [4, 10], EQ-5D (MCID = 0.074) [46], and KOOS (MCID = 9.1 points) [40]. No MCIDs between groups were found.

KOOS = Knee disability and Osteoarthritis Outcome Score. SF-12 = Short Form-12; PCS = Physical Component Summary, MCS = Mental Component Summary, EQ-5D = Euro QoL 5 Dimensions (Dutch version of Health Score).

				Patient	s anticipati	ng postope	erative sexu	al activity (n = 467)			
			M	en					Won	nen		
	Age all ^b	≤ 60 Yr	61-65 Yr	66-70 Yr	<u>></u> 71 Yr	P value ^a	Age all ^b	<u><</u> 60 Yr	61-65 Yr	66-70 Yr	<u>></u> 71 Yr	P value ^a
Preoperative anticipations of sexual activity after surgery	100% (n = 292)	19% (55/292)	22% (63/292)	25% (74/292)	34% (100/292)		100% (n = 574)	21% (124/574)	17% (99/574)	23% (133/574)	38% (218/574)	
ling in this in						0.004						< 0.001
- Back to normal	46%	60%	52%	39%	40%		32%	47%	32%	29%	24%	
(n = 315)	(134/292)	(33/55)	(33/63)	(29/74)	(39/100)		(181/574)	(58/124)	(32/99)	(38/133)	(53/218)	
- Large improvement	11%	15%	8%	10%	11%		10%	13%	16%	14%	3%	
(n = 87)	(31/292)	(8/55)	(5/63)	(7/74)	(11/100)		(56/574)	(16/124)	(16/99)	(18/133)	(6/218)	
- Moderate	6%	4%	5%	5%	8%		5%	7%	%6	5%	3%	
improvement $(n = 47)$	(17/292)	(2/55)	(3/63)	(4/74)	(8/100)		(30/574)	(8/124)	(66/6)	(7/133)	(6/218)	
- Slight improvement	3%	11%	3%	1%	5%		2%	1%	2%	3%	1%	
(n = 18)	(9/292)	(2/55)	(2/63)	(1/74)	(5/100)		(9/574)	(1/124)	(2/99)	(4/133)	(2/218)	
				Patients 1	not anticipa	ating posto	perative sex	kual activity	y (n = 399)			
"Does not apply"(n = 399)	35% (101/292)	20% (11/55)	32% (20/63)	45% (33/74)	37% (37/100)		52% (298/574)	33% (41/124)	40% (40/99)	50% (66/133)	69% (151/218)	
^a P values for ordinal cate; ^b P value (Age all) for diffe	gorical varia rences in pe	bles calcul ercentages	ated with th between me	ne Armitage en and wom	trend test. 1en with an	d without p	oreoperative	anticipatio	ns of sexual	activity afte	er surgery: p	< 0.001.

0 \$ patients were fulfilled/exceeded: 57% (85 of 150) compared to unfulfilled (43% [65 of 150]; p = 0.205). For the non-musculoskeletal comorbidity patients, the results were similar (Table 3).

Anticipation of sexual activity (n = 467)	Unfulfilled ^b	Fulfilled/ Exceeded ^b	P value ^a
Total	42% (197 of 467)	58% (270 of 467)	0.173
Back to normal	41% (130 of 315)	59% (185 of 315)	
Large improvement	41% (36 of 87)	59% (51 of 87)	
Moderate improvement	55% (26 of 47)	45% (21 of 47)	
Slight improvement	28% (5 of 18)	72% (13 of 18)	
Age group			0.316
\leq 60 years	37% (47 of 127)	63% (80 of 127)	
61-65 years	41% (42 of 102)	59% (60 of 102)	
66-70 years	49% (53 of 108)	50.9 % (55 of 108)	
\geq 71 years	42% (55 of 130)	58% (75 of 130)	
Gender			0.913
Men	42% (80 of 191)	58% (111 of 191)	
Women	42% (117 of 276)	58% (159 of 276)	
Preoperative functional status score			
KOOS-Total Items ^c			
Activities of daily living ^{c} (n = 422)	44 (19)	47 (17)	0.019
$Pain^{c} (n = 417)$	36 (18)	38 (16)	0.422
Quality of life ^{c} (n = 462)	33 (11)	34 (10)	0.512
$Sport^{c}$ (n = 447)	11 (15)	11 (13)	0.515
Symptoms ^c ($n = 419$)	44 (14)	44 (12)	0.967
Preoperative health status score			
SF-12 PCS ^c ($n = 437$)	31 (9)	33 (9)	0.101
SF-12 MCS ^c ($n = 437$)	54 (10)	57 (8)	0.006
$EQ-5D^{c}$ (n = 452)	0.6 (0.2)	0.7 (0.2)	0.146
EQ-5D VAS ^c ($n = 428$)	67 (16)	71 (17)	0.026
Preoperative comorbidity status			
Musculoskeletal ($n = 150$ of 302)	43% (65 of 150)	57% (85 of 150)	0.205
Non-musculoskeletal ($n = 279$ of 398)	41% (115 of 279)	59% (164 of 279)	0.343

Table 3: Postoperative Fulfillment in Patients Anticipating Postoperative Sexual Activity Relate to Baseline

^a P values for categorical variables calculated with Pearson's chi-square test; for continuous variables calculated with independent samples t test.

^b Unfulfilled means lower (< 1 step) outcome than preoperatively anticipated; Fulfilled/Exceeded means achieved Sexual Activity as anticipated or higher.

^c Values are presented as mean ± SD; scale 0–100 except for EQ5D (scale 0–1); higher score means better outcome. KOOS = Knee disability and Osteoarthritis Outcome Score; SF-12 = Short Form-12; PCS = Physical Component Summary; MCS = Mental Component Summary; EQ-5D = Euro QoL 5 Dimensions (Dutch version of Health Score). 4

Do Patients With Fulfilled Expectations Have a Better Postoperative Functional and Health Status?

Postoperatively, patients with fulfilled/exceeded expectations had better functional and health status after TKA than those with unfulfilled anticipations. Calculating the change between the patients' pre- and postoperative KOOS-total items, we found better functional status for all KOOS subscales for the fulfilled/exceeded group compared with the unfulfilled group. The differences exceeded the MCID norm, indicating clinically relevant differences (norm MCID 9.1). Differences between patients with and without fulfilled anticipations were largest for KOOS-Sport, mean 14 (\pm 0.1); but also high for KOOS-ADL: mean 11 (\pm 7) and KOOS-Pain mean 11 (\pm 6). When calculating the change between pre- and postoperative health status scores (SF-12 PCS, EQ5D, EQ5D VAS), we also found differences between both groups in postoperative results, but this did not exceed MCID norms (Table 4).

Prognostic Factors Regarding Anticipation of Postoperative Sexual Activity An increasing preoperative EQ-5D VAS score was the only prognostic factor we identified that was associated with an increased likelihood of fulfilled anticipation of sexual activity, one year after TKA, but the effect size was very small (odds ratio [OR] 1.02 [95% CI 1.01 to 1.03]) (Table 5). Some hypothetical examples are calculated. For instance, a 60-year-old male patient with an EQ5D VAS score of 60 has a probability of expectation fulfillment of 56% whilst a 65-year-old female, with an EQ5D VAS score of 70, has a probability of expectation fulfilment of 59% (Table 6). The c-statistic of our model was 0.61 (fairly low).

Change in functional and health status	Difference between pre- and postoperative score ^b				
Functional status	Unfulfilled	Fulfilled/ exceeded ^d	P value ^a	Difference ^b	Relative to MCID ^c
KOOS – Total Scores					
Δ Activities of daily	33 (24)	44 (18)		11 (7)	+
living ^e					
Δ Pain ^e	42 (25)	53 (18)	< 0.001	11 (6)	+
Δ Quality of life ^e	13 (19)	21 (16)	< 0.001	8 (3)	+/-
Δ Sport ^e	28 (27)	42 (27)	< 0.001	14 (0)	++
Δ Symptoms ^e	10 (16)	15 (16)	0.001	5 (1)	-
Health status	Difference between pre- and postoperative score ^b				
Δ SF-12 PCS ^e	11 (12)	15 (10)	< 0.001	4 (1)	+/-
Δ SF-12 MCS ^e	-0.2 (9)	-0.002 (8)	0.782	-0.2 (1)	
$\Delta EQ-5D^{e}$	0.2 (0.3)	0.2 (0.2)	0.036	0.05 (0.03)	
$\Delta \text{ EQ-5D (VAS)}^{e}$	6 (18)	11 (16)	0.008	5 (2)	NA

Table 4: Fulfillment Related to Pre- and Postoperative Functional and Health Status Recovery

^a P value for ordinal categorical variables calculated with Armitage trend test; for continuous variables calculated with independent samples t test.

^b Difference in scores: mean ± SD between unfulfilled and fulfilled/exceeded patients.

^c Clinical relevance was assessed with use of minimum clinically important differences: for KOOS, MCID = 9.1 points [40]; for SF-12, MCID = 4.5 [4, 10], and, for EQ-5D, MCID = 0.074 [46]; relative to MCID norm: ++ indicates "high" above MCID norm; + indicates "above"; +/- indicates "around/ just under"; - indicates "below", and, -- indicates "well below" MCID norm; NA means postoperative data not available.

^d Unfulfilled means lower results (< 1 step) than preoperatively expected; fulfilled/exceeded means achieved sexual activity as anticipated, or higher.

 $^{\rm e}$ Data are presented as the difference between preoperative and postoperative functional and health score; and as mean \pm SD; for total numbers we refer to Table 2; all scales ranged from 0 to 100 except the EQ-5D, which ranged from 0 to 1; higher scores indicated better outcomes.

MCID = minimum clinically important difference; KOOS = Knee Injury and Osteoarthritis Outcome Score; SF-12 = Short Form-12; PCS = Physical Component Summary; MCS = Mental Component Summary; EQ-5D = Euro QoL 5 Dimensions (Dutch version of Health Score).

Table 5: Prognostic Factors of Fulfillment in Patients Antici	pating	2 Posto	perative	Sexual	Activity
0 · · · · · · · · · · · · · · · · · · ·					

Variables associated with postoperative fulfillment	Odds ratio (95% CI)	P value
Age	0.97 (0.95 to 1.00)	0.063
Gender (women)	1.08 (0.68 to 1.71)	0.748
Preoperative EQ-5D VAS a, per unit increase ^a	1.02 (1.01 to 1.03)	0.006

^a Higher score means better outcome; EQ-5D = Euro Qol 5 Dimensions.

Gender ^a	Age ^b	EQ-5D VAS ^c	Probability of fulfillment
Men	60	60	56%
Women	60	60	58%
Men	65	60	53%
Women	65	60	55%
Men	70	60	49%
Women	70	60	51%
Men	60	70	61%
Women	60	70	63%
Men	65	70	58%
Women	65	70	59%
Men	70	70	54%
Women	70	70	56%
Men	60	80	65%
Women	60	80	67%

Table 6: Impact of EQ-5D VAS, Gender, and Age on Postoperative Fulfillment of Sexual Activity, Some Hypothetical Examples

^a Gender: OR, 1.08 (95% CI 0.68 to 1.71).

^b Age: OR, 0.97 (95% CI 0.95 to 1.00).

^c EQ5D VAS: OR, 1.02 (95% CI 1.01 to 1.03).

Discussion

Sexual activity is an important aspect of quality of life, even more, since a new generation of active seniors expects more quality of life after retirement [27, 37]. Return to (normal) sexual activity may be an important goal for many TKA patients [27, 40], and the likelihood of achieving this goal may depend on how successful the surgery is in terms of overall pain relief [37]. We sought to evaluate expectation fulfillment and prognostic factors associated with sexual activity 1 year after TKA. Using a large prospective cohort study, we additionally explored patients' characteristics and PROs, in depth. We found that before surgery, men more often expected a return to normal sexual activity; 40% to 50% anticipated (back to normal) sexual activity after surgery. As expected, anticipation decreased with increasing age, both for men and women. In our study, a high proportion of patients experienced unfulfilled expectations of sexual activity after surgery (approximately 40% for both men and women), a frequency that was much higher than one previous study, which found that proportion to be about 25% [47]. Our findings suggest that this topic deserves greater attention during presurgical consultation [38, 39].

Limitations

Patients with incomplete follow-up on fulfillment of sexual activity anticipations were excluded, but statistical testing between included and excluded respondents showed no differences in patient characteristics (such as, age, gender, preoperative functional, and health status), suggesting that selection bias was not likely to be a severe limitation of our study. There were, however, other important limitations. First, the assessment of preoperative anticipation and its fulfillment of sexual activity were limited to one item of the validated HSS Knee Replacement Expectations Survey. Even though the HSS questionnaire has been validated as a 17-item instrument, the reliability of extracting one item is unknown [6, 23, 51]. In single-subject research, prior studies have recommended the use of multi-item questionnaires [7, 22]. In our LOAS cohort, we aim to cover all ICF (International Classification of Functionality) aspects of a person. Consequently, validated instruments for functional and health status recovery (pre- and postoperative stage) were employed in this prospective, single-subject study on sexual activity. Second, this is an exploratory study on sexual activity anticipation in TKA patients, a sensitive topic that is not frequently studied [4, 18]. Although we evaluated a large group of patients, we note that PROs are subjective. Even so, PRO research is increasingly being seen as important [15, 17, 25]. A related limitation is the use of the HSS questionnaire as a postoperative instrument [35]. Originally, the HSS questionnaire was developed for preoperative assessment of anticipations and for communication in preoperative consultations, but not for assessment of postoperative expectation fulfillment [35]. Our approach, although not formally validated, was used before by other studies that measured postoperative expectation fulfillment [36, 41, 43, 47], and we believe it has strong face validity. Still, this procedure could have reduced the reliability of this study [55].

Furthermore, the original HSS Knee Replacement Expectations Survey contains a "does not apply" and "I do not expect this" response option [26, 35]. And, over time the HSS changed and combined both scores to a single "does not apply" option [1, 2, 36], which is also in the validated Dutch version [1]. Related to this is the lack of exact definitions of answering options as "back to normal" and "does not apply." The HSS answers may have been subject to multiple interpretations [20]. Patients may have had multiple reasons to fill in "does not apply," like not knowing how to answer or having expectations that were lower than the available scoring options (for example, expecting to worsen or not to improve) [47]. It also could be that sexually active patients without a preoperative expectation filled in this option because they do not anticipate a change in their sexual activity status. We therefore excluded the data of the respondents who filled in "does not apply" for further analysis [13].

Finally, the proportion of patients with unfulfilled expectations may be overrepresented, because a control or comparison non-TKA group was not surveyed. In addition, the current study is sufficiently generalizable to the Dutch population with symptomatic end-stage knee osteoarthritis of the knee who were scheduled for TKA. However, global generalizability is limited because of cultural differences on sexual activity [47]. For that matter baseline information on patients' sexual activity would make comparison with different populations possible, however we did not collect this baseline.

Preoperative Expectations Regarding Sexual Activity and Its Fulfillment Several studies evaluated preoperative expectations of TKA in patients [13, 24, 35, 36, 43, 47, 54], but only three specifically reported on sexual activity [36, 43, 47]. Two of them compared preoperative expectation of sexual activity to postoperative fulfillment of expectation (measured with HSS survey) [43, 47]; and one related preoperative expectation of sexual activity (HSS) to postoperative satisfaction (with a self-developed instrument) [36]. But compared with the current study, these studies were smaller and the data on the item sexual activity were incomplete. Another prospective study found 24% unfulfilled preoperative expectation of sexual activity 1 year after TKA, compared with 42% in the current study [47]; these differences might be due to the fact that the data on the issue of sexual activity were incomplete as well. The two other studies [36, 43], which measured the "importance" of the expectation score, reported about sexual activity as the least important expectation. In one study, 63% of respondents did not report sexual activity (HSS questionnaire) [36] which may have influenced the findings. And, the other study gathered complete data, but in this study, patients considered sexual activity to be least important as well, although fulfillment was greater than expected [43]. Basic topics as "relief of pain", "ability to walk", "ability to put on shoes and socks", even "psychological wellbeing, always will be of more importance compared with items as "sexual activity" or "monetary reimbursement" (both not applying to every respondent) [36, 54]. Consequently, Cross et al. found that the preoperative mean importance score of sexual activity (based on a follow-up time of 6 months) increased substantially after excluding the "does not apply" patients [13]. This is important to know when investigating "less important issues." Besides, it is known that the new generation

of patients has higher expectations towards regaining high-level (leisure) activities [16, 37]. If studies continue in counting "does not apply" answers (or "missing data") in calculating mean results for entire samples, a clear picture of the impact of TKA on that specific issue will not be obtained, and consequently, it will not be recognized for achieving better quality care for patients.

With respect to the diversity of studies describing the patients' pre- and postoperative functional and health status and preoperative expectations [13, 24, 35, 43, 47, 54], no study to our knowledge has looked to postoperative fulfilled or unfulfilled expectation per subgroup and related results to the change in the patients' postoperative recovery, as we did. No study to our knowledge further calculated MCID between both subgroups (fulfilled and unfulfilled), but this study did and found high levels above MCID norm foor all KOOS functional variables.

Prognostic Factors for Fulfillment of Expectations and Implications for Practice Our study shows that the baseline EQ-5D VAS score was the most important prognostic factor for fulfillment of anticipated postoperative sexual activity. Others have studied prognostic factors for a broader set or more generic expectations, these studies found prognostic factors in mainly the baseline functional area, such as KOOS Quality of Life [21]. Surgeons should be aware when patients' anticipation of postoperative sexual activity is unfulfilled, especially in patients with postoperative low functional recovery. Comparing the current study to our previous study in THA patients, results of both studies are similar (for both, approximately 40% of unfulfilled expectation-fulfillment in patients anticipating postoperative sexual activity, regardless of gender) [20]. This finding needs further research in both populations.

Another study compared the postoperative knee function of TKA patients to ageand gender-matched controls [52]. This study showed that sexual activity was deemed important in 70% of TKA subjects versus 67% of controls, and that control participants also reported a certain continuous deterioration of knee function. However, in regard to sexual activity, the control participants more often felt unrestricted (86%) compared with the TKA patients (64%, 1 year postoperative) [52]. When activities become more demanding, the gap between the controls and the TKA population widened, with four times as many difficulties when it came to activities like squatting and kneeling for the TKA population. Referring to the common sexual positions of Dahm et al. [14], a considerable number of these positions call for kneeling or squatting. It may be that patients with unfulfilled anticipations were mainly hindered by functional limitations, such the ability to kneel and squat, during more-demanding sexual activities. Although this aspect of functional limitations related to sexual activity needs more study, it may be relevant to patients to be educated about comfortable and safe sexual positions after TKA. It is not common for patients and surgeons to talk explicitly about sensitive issues such as these [14, 19, 50], and perhaps because of this omission, patients may set unrealistic expectations preoperatively. Patient education tailored to the needs of patients and partners may help establish realistic expectations. More knowledge of patients' preoperative anticipation of sexual activity and postoperative fulfillment may help surgeons to provide adequate patient education, which may improve care quality and patient satisfaction.

Conclusions

Regardless of gender, we found that about two out of five patients anticipating postoperative sexual activity indicated that their expectations were not met 1 year after TKA. These patients had worse functional recovery scores compared to patients who achieved the anticipated level of sexual activity. Surgeons should be aware that many patients anticipate postoperative sexual activity, and that this applies to patients of all ages, and for women and men alike. The results underscore the importance of more qualitative research to clarify this important and infrequently discussed topic in orthopaedic practice.
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Chapter 5

Perceptions on Sexual Activity After Total Knee and Total Hip Arthroplasty: A Mixed Method Study of Patients, Partners, and Surgeons

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Background

In-depth insight into couples' experiences of sexual activity before and after total hip arthroplasty (THA) and total knee arthroplasty (TKA) is lacking. The aim of this study was to explore patients' and partners' experiences, complemented by surgeons' opinions on safe resumption of sexual activity after surgery.

Methods

Mixed method study: 1) Semi-structured interviews among sexually active couples, 1.5 years postoperatively and 2) A survey among surgeons about recommendations of sexual activity after THA/TKA.

Results

Of the 150 invited couples, 90 (60%) responded (THA: n = 39; TKA: n = 42). Five couples participated (THA: n = 3; TKA: n = 2), while 85 (94%) couples refused participation. Two themes emerged: "Couples physically and mentally adjusted to the new situation" and "Couples undoubtedly trusted the surgeon as the provider of information." In total, 27% (47/175) of THA surgeons participated. Fifty percent agreed with the recommended sexual positions researched by Charbonnier et al. Opinions differed widely regarding when to safely resume sexual activity. Of the TKA surgeons, 36% (76/211) responded. Almost all surgeons (95%) agreed that there were no restrictions. However, some discomfort was expected when patients bend the knee or kneel during sex. Half of the surgeons indicated that providing information about sex was necessary.

Conclusions

All couples physically and mentally adapted to the new situation without considering safety measures. Patients trusted surgeons in providing safety information. Surgeons should inform patients succinct and explicitly, especially since surgeons' recommendations showed great variability. More motion research on hip and knee may add to uniform guidelines.

Background

Every year, millions of patients worldwide undergo total hip arthroplasty (THA) or total knee arthroplasty (TKA) for symptomatic osteoarthritis (OA) [1, 2]. Due to the improvement in the survival times of prostheses and surgical techniques, patients are operated on at both, younger and older ages [3–5]. Maintaining sexual activity is associated with better quality of life and well-being [6–15]. Although, for many patients, sexual activity is an important aspect of their lives [16, 17], there is still a general taboo among patients and professionals to address this issue during consultations [9, 18–23].

OA of the hip causes sexual difficulties, such as lower sexual frequency or functional limitations during sexual activity, caused by stiffness and pain during external rotation or abduction of the legs [13–15]. Sexual difficulties have been scarcely addressed in literature, particularly for the knee joint, not for the hip [12–14, 24–29]. In addition, the quality of most studies is low to moderate [24]. Most hip studies have a retrospective design [13, 14, 25] and describe that OA can affect the sexual relationships with partners [15, 27]. Two studies even mentioned that in 20 to 30% of THA patients, sexual dysfunction was a reason to undergo surgery [13, 14]. Other studies showed that patients may experience fear of damaging the prosthesis after surgery, which can limit sexual activity as well [11, 12, 26]. After surgery, THA is associated with improvement of sexual activity [14, 25, 26], although the magnitude of effects varies highly [24].

OA of the knee causes sexual difficulties as well and until now, this is scarcely studied. Recently, two retrospective studies report about sexual activity of patients undergoing TKA [12, 30]. Nunley et al., found that 98% of their sexually active cohort of (THA and) TKA patients under 60 years returned to sexual activity after surgery [12]. In this first quantitative study, qualitative information was not incorporated. Compared to Nunley, Kazarian et al., included patients who were slightly older. They found that 60% of patients were more easily engaged in sexual activity, although only a proportion of patients showed improvement. Postoperatively 25% had less sex and 70% did not felt greater mobility or range of motion. In 54% of patients, kneeling during sex because of diminished flexion was reported [30], an improvement compared to preoperatively, where almost all patients (97%) avoided to kneel during sex and needed to change their sexual positions to accommodate the knee [30]. Therefore, it is expected that kneeling limitations during sexual activity will need more attention in the patient information.

Previously, we conducted studies on patients' expectations of sexual activity after THA [31] and TKA [32]. In both studies, expectations of postoperative sexual activity were not met in up to 40% of the patients. The causes and consequences of these unmet expectations are unknown. It may be related to the above-described functional difficulties and consequences for the kneeling function during sexual activity or may be related to the lack of knowledge about what to expect, when, and how to comfortably resume sexual intercourse [11, 30]. Wall et al., were the first to prospectively investigate the need for information. Preoperatively, 55% of the patients would like to have information about sexual activity after surgery, while postoperatively, 83% stated they were underinformed by the surgeon [26]. Preoperatively, patients were not aware of relevant outcomes. So far, difficulties during sexual activity after THA and TKA have rarely been recognized by orthopedic surgeons; consequently, the necessary patient information is not always provided [14, 26, 33, 34]. More specifically, if certain sexual positions are at risk for adverse outcomes (e.g., dislocation of the hip and insert luxation of the knee), it is not clear what surgeons will advise [33, 35].

To date, exploration of sexual activity in patients undergoing THA and TKA has never been researched in depth and using a qualitative study. Hence, research in the context of the couples' experiences during pre- and postoperative sexual activity is also lacking. Therefore, the aim of this study was to explore patients' and partners' experiences, complemented by THA/TKA surgeons' recommendations on safe resumption of sexual activity after surgery.

Method

Study Design

A mixed method study was conducted, consisting of

- 1. Semi-structured interviews about pre- and postoperative perspectives of THA/TKA patients and their partners, 1.5 years after surgery.
- 2. A survey was conducted among THA and TKA orthopedic surgeons to gather the surgeons' perspectives on postoperative resuming of sexual activity.

Study Population

Patients and Their Partners

THA and TKA patients and partners who participated in the Longitudinal Leiden Orthopedics Outcomes of Osteo-Arthritis (LOAS) Study [36] and were treated in three participating hospitals (university, top referent teaching, basic/general) were invited to participate in this study.

To determine patient eligibility, medical records were screened by the orthopedic surgeon of the outpatient clinics. Patients were eligible if they had primary hip or knee OA, undergone (uni- or bilateral) THA or TKA, and had no revisions. Patients were cohabitating, living apart, or married, and were sexually active (again) or had the intention to resume sexual activity postoperatively. We excluded sexual inactive couples, patients who had stopped being sexually active before the onset of OA, and without the intention to resume sexual activity. Since it was not known who was sexually active, all 150 eligible patients received an invitation by mail:

- 1. An invitation letter signed by the attending surgeon in which the patient and partner were informed about the aims and inclusion criteria, ending with the question whether they were willing (were able) to participate in an interview. Although the subject of sexuality covers a broad multidimensional area [37], we informed the couples that the interview would focus on the functional aspects (sexual intercourse with a prosthesis) and that the interviews would be conducted by an orthopedic surgeon and researcher.
- 2. Two informed consent forms for both the patient and partner were provided if they decided to participate.
- 3. A non-participation return form on which patients and partners could indicate why they were unwilling to participate.
- 4. Return envelope with postage.

After 4 weeks, one reminder was sent. Interviews were planned by telephone and took place within 10 weeks of informed consent was obtained.

The Regional Institutional Review Board of the University Medical Centre Leiden (Zuid Holland) approved the study (Number N20.078) and determined that, according to the Dutch legislation, this study does not meet the scope of the Medical Research Involving Human Subjects Act. Patients were informed about the study protocol according to the declaration of Helsinki. Written informed consent forms were obtained from the patients and their partners prior to the start of the interviews, including consent to record the interviews.

Orthopedic Surgeons

Only orthopedic surgeons who were member of the Dutch Hip Society (DHS) and Dutch Knee Society (DKS) in the Netherlands (i.e., these orthopedic surgeons can be member of both Societies). Both, the DHS and DKS are working groups of the Netherlands Orthopedic Society (NOV). As such, these orthopedic surgeons have extensive experience in THA and/or TKA surgery. They were invited to participate by post.

The addresses for the THA and TKA working groups of orthopedic surgeons were retrieved from the NOV by member lists (THA, n = 147; TKA, n = 211). Members living abroad and non-orthopedic surgeons were excluded. The board obtained informed consent from their members. One reminder was sent to surgeons in the TKA group. It was not possible to remind the THA surgeons of the THA working group, because we did not obtain permission of the board.

Data Collection

Interviews With Patients and Their Partners

Patient characteristics, that is, age, duration of OA, date of surgery, operation technique for hip, duration of relationship, use of medication, comorbidities, sexual activity status, satisfaction rates were assessed using a survey. The survey also contained three self-reported VAS scores at the start of the interview: the EQ-5D health status score (VAS 0–100), a score indicating the patient's satisfaction with the result of surgery (VAS 0–10), and a score indicating the patient's satisfaction explicitly based on regaining sexual activity with a prosthesis (VAS 0–10).

An Interview guide (additional file) was constructed based on prior studies of the research group and the literature [24, 31, 32, 34]. This interview guide contained the following themes: significance of preoperative difficulties of sexual activity, postoperative change(s) in sexual activity, awareness of sexual expectations, and need for information about how and when to return to sexual activity safely. The topics in the interview guide were piloted in two interviews: one female hip patient and her spouse, and one female knee patient without her partner (due to his last-minute withdrawal). Based on the outcomes of the pilots, we decided to use these "Dahm-drawings" as a tool in the final interviews [33] (Figure 1).



Figure 1: Twelve Common Sexual Positions.

Notes:

¹ Green tick shows a "permitted" sexual position, while a red cross means that this sexual position is not advised for patients with THA by Charbonnier et al. [35].

² This chart was used during the interviews with couples and for both surgeon's survey.

For THA surgeons, the chart was sent out with recommended positions.

For TKA surgeons, the chart was sent out without recommended positions.

The chart was presented to patients and partners during the interviews without recommended positions. The twelve sexual positions were modified from the study of Dahm and Charbonnier et al. [33, 35].

Survey Among Surgeons

The surgeons' survey focused on expert opinions on THA and TKA practices and based on recommendations for regaining sexual activity after surgery. The DHS working group of the NOV was invited to comment. The survey consisted of four topics:

- The advice per sexual position (for both men and women), based on the study of Charbonnier et al., in which a virtual total hip collision simulation was performed, extrapolated from in vivo MRI positions [35]. This chart (Figure 1) was sent out with the advised positions for THA patients.
- 2. The estimated risk for luxation of the prosthesis (VAS 0–10).
- 3. The postoperative waiting time before resuming sexual activity safely. The answer options were adapted from the studies of Dahm and Wall et al. [26, 33].
- 4. The surgeons' surgical approach.

For TKA patients, the TKA workgroup survey consisted of 3 topics:

1. Whether the surgeons agreed with the statement that there are no limitations for TKA patients with regard to the twelve sexual positions adapted from the study of Dahm et al.

This chart (Figure 1) was sent out without the advised positions for THA patients.

- 2. Whether this topic should be included in TKA patient" information.
- 3. The postoperative waiting time before resuming sexual activity safely. Answer options were adapted from the studies of Dahm and Wall et al. [26, 33]

Data Analysis

Semi-structured interviews were conducted in June 2021 at an outpatient clinic. Two researchers, RTEH (investigator) and PFS (orthopedic surgeon), conducted the interviews. PFS interviewed the couples/patients, and RTEH supervised the interviews and made field notes. All interviews were audiotaped and transcribed verbatim using Microsoft Word for Mac (version 16.66.1, 2022, Redmond, USA). For analyzing the data and to complete our work, we used the Computer Assisted Qualitative Analysis Software Program Atlas.Ti (version 9.0 Windows, Berlin, Germany).

The analyses consisted of three phases. First, transcripts were read and reread to get a first impression of "the total context" of the interviews. Second, RTEH and MDO used an iterative and inductive coding approach, following an open axial and selective coding procedure [38]. The interviews were coded independently, with constant discussions on interpretations and building the final code list to reach a consensus. Third, both researchers formulated themes emerging from group codes by applying the diagram affinity method [39], resulting in the final themes for presentation. Data analysis of the surveys consisted of descriptive statistics reported as frequencies and percentages for categorical data). The data were analyzed using IBM SPSS Statistics (version 24, Armonk, New York, United States).

Results

Of the 150 invited couples, 90 response forms were returned (response 60%: THA: n = 39; TKA: n = 42). Five patients in a relationship were willing to participate in the

interview study. These couples were eligible because they resumed sexual activity postoperatively. Eighty-five non-participation forms were received, of which 4 were incomplete, resulting in 81 non-participation forms. Of this group, 47% (n = 38) were sexually inactive due to various reasons (Table 1A). The remaining group (n = 43; 53%), was sexually active and resumed without difficulties.

Total number of persons who declined participation [#]	n = 81 (100%)
Reasons for non-participation##	140
Not sexually active	38/81 (47%)
Sex is no longer part of life	13
Partner passed away	5
Comorbidities play a role	
Patient	14
Partner	6
Resumed sexual activity again	43/81 (53%)
Resumed without difficulties	38
Resumed despite age is okay	2
Resumed despite comorbidities is okay	3
Reluctance to discuss sexual activity	48/81 (59%)
Do not want to talk about sexuality	19
Issue not important	7
Too personal topic	12
Not appropriate in conversation with an orthopedic surgeon	5
I feel uncomfortable or ashamed to talk about sex	5
Other reasons for non-participation	11/81 (14%)
Rehabilitation difficulties	4
No time to participate	3
Other	4

Table	1A.	Reasons	for	Non-P	Partici	pation
					*** ****	P

 $^{\#}$ N = 81/85 non-participation forms (4 forms were missing).

^{##} More than one answer was allowed to be given (total 140 reasons).

Eleven couples responded other reasons for non-participation, such as no time. Respondents could fill out more than one reason why they were not willing to participate. More specifically, the most common mentioned reason was that 48/81 (59%) patients felt reluctance to discuss sexual activity. About half of the THA patients (19 out of 39) and 69% (29 out of 42) of TKA patients indicated this reluctance. More females (65%) than males (53%) were reluctant. More detailed information per arthroplasty type, gender, and age groups are shown in Table 1B.

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Respondents: n = 81 #		Arthro	plasty	Gen	der		Age g	roups	
	Total	THA	TKA	Men	Women	< 65y	65-70y	71-75y	> 75y
Total respondents	81	(n = 39)	(n = 42)	(n = 38)	(n = 43)	(n = 25)	(n = 20)	(n = 20)	(n = 16)
Total of reasons	140	(n = 66)	(n = 74)	(n = 64)	(n = 64)	(n = 48)	(n = 28)	(n = 34)	(n = 30)
Not sexually active	38	24	14	19	19	4	12	12	10
Sex is no longer part of life	13	8	5	9	7	0	3	5	5
Partner passed away	Ŋ	4	1	1	4	1	ю	0	1
Comorbidities play a role:									
Patient	14	9	8	10	4	2	5	3	4
Partner	9	9	0	2	4	1	1	4	0
Resuming sexual activity	43	20	23	20	23	18	7	10	8
Resuming sexual activity (without difficulties)	38	17	21	18	20	15	7	6	7
Resuming despite age	2	1	1	1	1	0	0	1	1
Resuming despite comorbidities	б	2	1	1	2	3	0	0	0
Reluctance to discuss sexual activity	48	19	29	20	28	23	7	6	6
Do not want to talk about sexuality	19	10	6	8	11	11	2	3	ю
Sexuality as an issue is not important	7	2	5	2	5	ю	1	1	2
Too personal topic	12	5	7	9	9	9	1	33	2
Not appropriate in conversation with a surgeon	5	1	4	2	3	1	1	1	2
I feel uncomfortable/ashamed to talk about sexuality	5	1	4	2	3	2	2	1	0
Other reasons for non-participation	11	Э	8	5	9	3	2	3	б
Rehabilitation difficulties	4	1	б	2	2	1	1	1	1
No time to participate	3	1	2	1	2	2	0	1	0
Other	4	1	Э	2	2	0	1	1	2
# N = $81/85$ non-participation forms (4 forms were missi) More than one answer was allowed to be given (in total 1 ⁴	ing). 40 reaso	ns).							

1. Perceptions on Sexual Activity of Patients and Partners

Due to the last-minute withdrawal of one partner, one male patient came alone at the time of the interview. The preoperative duration of OA ranged from 3 months (patient 4, THA, male) to 12 years (patient 5, TKA, female). All patients and partners reported health issues, except for one 65-year-old female partner (Table 2). Non-musculoskeletal diseases, such as hypertension and cardiovascular issues were the most mentioned issues. None of the patients or partners had undergone other orthopedic surgery (e.g., spine fusion). At the time of the interview none of the patients suffered of (technical) complications, except for one patient who experienced incidental pain. Except for this patient, all EQ-5D VAS scores were 80 or higher, indicating a good health status at the time of interviewing. In addition, the satisfaction scores were > 8, except for the patient with incidental pain. All patients were satisfied about regaining sexual activity with a prosthesis (Table 2).

The mean duration of the interviews was 43 minutes (range 32–55 minutes). Two themes emerged from the interviews:

- 1. Couples adjusted naturally the new situation: physically (to sexual positions) and mentally (to the moment they felt ready).
- 2. Couples undoubtedly trusted the orthopedic surgeon as provider of information about safely resuming sexual activity.

Theme 1: Couples adjusted naturally the new situation: physically (to sexual positions) and mentally (to the moment they felt ready)

Preoperatively, arthritic joints physically hindered all patients. Although OA limited all couples in their daily activities, they remained sexually active. Patients indicated that they adapted to the situation. They changed their routine leg position to be comfortable and some lowered their frequency of sexual activity.

"Well, I noticed that.... uhh... with me it happens naturally..., that you also adjust in your being together... unnoticed..., with the fact that with certain positions, you do act more cautiously by saying, watch out..., or... be carefully... but of course it happens gradually." (female patient 2, bilateral THA).

The presence of preoperative pain was predominantly mentioned as a factor contributing to the loss of quality of life. Patients were hindered during activities of daily living, sports, and recreational activities.

	Duo – 5***	Female	TKA (first)	No	No	Acnes disease	Hypertension Mental problems Cardiovascular problems Chronic lung disease Lower back pain	61	65
	Duo – 4***	Male	THA (second one) posterior	Bilateral THA and TKA	No	Hypertension Cardiovascular problems Prostate and bladder issues	None	73	65
	Duo - 3	Male	THA (first) posterior	No	No	Hypertension Prostate and kidney issues	Hypertension Chronic lung disease	55	55
	Duo - 2	Female	bilateral THA anterior (first)	No	No	Hypertension Cardiovascular issues	Hypertension Cancer	56	61
icipants	Single 1**	Male	TKA (first)	No	No	Lower back pain	Hypertension Mental problems Osteoarthritis Migraine	68	73
Table 2: Characteristics of the Part	Participants [*]	Gender patient	Joint replacement' Patient Surgical Approach	Joint replacement (partner)	Other orthopedic surgeries in couples (e.g., spine fusion)	Self-reported health issues of patient	Self-reported health issues of partner	Age patient	Age partner

Duration of the relationship (in years)	40	31	16	49	10
Time after surgery (in months)	16	17	16	17	14
Postoperative estimated resuming time of sexual activity	> 8 weeks	> 3-4 weeks	> 8 weeks	> 6-8 weeks	> 12 weeks
EQ-5D Score VAS (0-100) #	85	87	80	37##	80
Satisfaction score related to sexual activity after surgery VAS (0–10) #	10	10	10	6	6
Satisfaction score related to THA/ TKA outcome VAS (0–10) #	8.5	10	8	e **	6
Abbreviations: TKA total knee arthro Anterior Cutaneous Nerve Entrapmer VAS 100 or 10: highest score. All heterosexual couples, surgical rev " Single interview; partner withdraw" " Female partner recently underwent "" Patient was occasionally dependen	plasty; THA total hip ant Syndrome. visions were excluded. (last minute). t TKA (3 months post tt on a wheelchair due	arthroplasty; VAS v operatively) and re- to fatigue.	isual analogue so ported some reh	ale; EQ-5D Euro Quality 5 Di abilitation difficulties.	nensions; ACNES Syndrome

* At the time of the interview.

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Pain was the most important reason for this lower score.

"Yes, it was from being able to walk for a full day to only being able to walk for an hour... well, and since we really like walking that was a thing..., but I didn't perceive a lot of pain during sex." (male patient 3, THA).

This couple (no. 3) had the routine of being sexually active every weekend. They worked a lot during the week and found sexual activity important. They noted that despite OA, it was nice to experience that sex still was possible without pain. The couple enjoyed being sexually active and it was pleasurable for both. It brought a mind-set and focus on intimacy instead of impairment, especially since their favorite long-distance walking was no longer possible.

Postoperatively, couples adjusted in a natural way as well. They all resumed sexual intercourse after surgery the moment they felt ready again. Four couples reported that this moment was approximately at the time of the check-up photo appointment at the outpatient clinic (6 to 8 weeks after surgery).

"I was very deliberately... took the warnings seriously and waited until the 6 weeks were over and the check-up X-ray was taken..." (male patient 3, THA). His wife continued: "I don't remember thinking about safe resumption; I was really only concerned with... well..., he's having surgery, he has to recover for 6 weeks... and we have to arrange things..., how is he going to exercise again, with those crutches, and... eh... that walker..." (spouse patient 3).

"The first month you are really rehabilitating, then you don't have a desire for sex. When you feel you like to do it again... then you just do it." (female patient 2, bilateral THA).

Safe handling of the prosthesis during sexual activity was hardly an issue. None of the participants had seriously considered potential risks. The fear of damaging the prosthesis did not play a role in waiting to resume sexual activity.

"We had no fear of damage; however, we have quite a limitation with all our prostheses", the wife said looking to the drawings of the positions... (spouse patient 4).

Only one partner had experienced fear of hurting his wife (patient with bilateral THA) and was afraid to inflict pain. However, as his wife was not scared at all. He had not brought up his concern to her. His wife quoted:

"Of course it was a thing, but I felt that it was nice again. And I think when you're together for a long time you look for ways that are pleasant".

All respondents (retrospectively) assumed that sexual activity would not get worse after surgery and might even improve compared to preoperative experiences. For TKA, none of the patients mentioned inconveniences. The female TKA patient (no. 5) was satisfied that she had been treated after 12 years of waiting for surgery. The private circumstances of the male patient (no.1) temporarily reduced this couple' sexual activity. In addition, during his interview, he pointed out that his preferred sexual position did not require him to bend the knees.

Theme 2: Couples undoubtedly trusted the orthopedic surgeon as provider of information about safely resuming sexual activity

Patients scheduled for surgery received general information in a booklet. Patients considered this information to be complete, assuming that all relevant topics were included.

"The information is actually very good; everything is done very carefully and to the point. You also get a whole booklet yes, everything according to protocol..., so why not add something about sex, for sure this could be added...?" (spouse patient 2).

None of the respondents remembered that the topic of sexual activity was mentioned by the surgeon postoperatively. All implicitly expected that orthopedic surgeons would bring up relevant issues, including advice on sexual activity, when this would be important.

"I thought it will be alright; I had confidence in him... And I also experienced something like... uh... the orthopedic surgeon will of course warn me for something, isn't?" (female patient 2, bilateral THA).

Almost all patients and partners retrospectively stated that they had no questions about sexual activity during the consultation, except for one couple. This couple was reluctant to ask questions about safe resumption during the orthopedic consultation and tried to find answers on the internet. All participants stated that they would have wanted to know if there was a chance of damaging the prosthesis during the resumption of intercourse. They all trusted that the surgeon would inform them about important topics.

2. Perceptions on Sexual Activity of Surgeons

Approximately 27% (n = 47/175) of THA orthopedic surgeons completed the questionnaire. Of this group, 38.3% (n = 18) performed the anterior approach, 44.7% (n = 21) performed the posterior approach, 6% (12.8%) performed both approaches, and 4.3% (n = 2) performed the direct-lateral approach. In addition, we asked surgeons about which positions were permitted based on the results of Charbonnier and colleagues [35] (Figure 1). In total, 25 (53.2%) answered that Charbonnier's advice could be used as a guideline for THA patients, while 20% of the surgeons (n = 9) indicated that this advice could not be used. Thirteen THA surgeons (28%) answered that every sexual position was safe. The estimated risk of luxation was rated as low (VAS score: 3 or lower).

We asked the surgeons for their opinions regarding the waiting time to resume sexual activity. Regardless of the surgical approach, opinions differed. About 30 to 40% of the surgeons felt that sexual activity could be immediately resumed as soon as the patient feels ready, while others (30–40%) advised a waiting period with a duration of 6 to 8 weeks (Table 3).

Waiting time for resuming sexual activity after surgery ^{**}	Total	Anterior approach	Posterior approach	Posterior and anterior approach [*]	Direct- lateral approach
Ν	47	18	21	6	2
Immediately, as soon as	17 (36.2%)	7 (38.9%)	7 (33.3%)	3 (50%)	0
the patient feels ready					
After 2 to 4 weeks	3 (6.4%)	3 (16.7%)			0
After 6 to 8 weeks	20 (42.6%)	6 (33.3%)	9 (42.9%)	3 (50%)	2 (100%)
After 3 months	4 (8.5%)	2 (11.1%)	2 (27.8%)		0
Missing	3 (6.4%)	3 (16.7%)			0

Table 3. Perspectives of THA surgeons: waiting time per approach

* These surgeons used both approaches; advice per approach is not given.

** Scales were adapted from the study of Dahm et al., and Wall et al. [26, 33].

Approximately 36% (n = 76/211) of TKA surgeons returned the survey and 95% agreed that there were no restrictions on postoperative sexual activity based on the sexual positions (Figure 1). These surgeons agreed that sexual activity was immediately allowed as soon as patients felt ready. The remaining surgeons (5%) did not agree. They stated that there was a risk of dislocation of the insert, especially regarding sexual positions that required deep flexion of the knee.

Fifty percent of surgeons agreed that deep bending might cause inconvenience, for instance, for men and women who used position 3 and for women who used positions 10 and 11 (Figure 1). Approximately half (51.3%) of the surgeons indicated that providing information about sexuality to patients after surgery was necessary, while the other half (47.3%) did not agree.

Discussion

This mixed method study explored THA/TKA patients' and partners' experiences regarding perspectives of sexual activity before and after surgery, complemented by the surgeons' recommendations on safe resumption of sexual activity. More specifically, to examine whether certain sexual positions would be at risk for adverse outcomes (e.g., dislocation of the hip, insert luxation of the knee) and whether surgeons advise any safety measures.

The couples who participated estimated that they had resumed intercourse within three months after surgery. They adapted to new situations naturally. Before surgery, if necessary, they changed the leg position during sexual activity, while after surgery they resumed sexual activity as soon as they felt ready to have sex again. This finding was somewhat unexpected. In our previous studies, expectations on postoperative sexual activity were not met in up to 40% of THA and TKA patients, one year after surgery [31, 32]. The cause and consequences of why expectations are not met are unknown. We thought that this might be related to functional difficulties with the prosthesis (30), or the lack of knowledge about what to expect realistically [11, 30]. Sexual dysfunction at older age is frequently reported [7, 16, 40–42]. Interestingly, our couples stated they were sexually active and did not experience any sexual dysfunction despite their age (range 55–73 years). Extensive literature pays attention to sexual dysfunction related to comorbidities [43–48], However, our patients and most partners (except one) reported the presence of health issues and yet they did not report sexual dysfunction.

The limited available literature on sexual activity in THA and TKA patients have shown a preoperative reduction in sexual frequency [12, 27]. In our study, only one couple had experienced decreased sexual frequency preoperatively, but did not express this as troublesome. The preoperative limitation of recreational activities and sport (e.g., long-distance hiking, hockey, traveling) was even more disappointing for most couples. In contrast, sexual activity was still present preoperatively, since it required less strenuous capacity, which possibly gave distraction from pain. One couple explicitly noted that despite OA, it was nice to experience that sex still was possible without pain. Some researchers hypothesized that oxytocin, which is released during intermate intimacy, may have a modulating effect on pain [49, 50]. However, a review reported mixed results with regard to the association of oxytocin on emotional functioning and on the effect of pain reduction [51].

The surgeons' recommendations of safe sexual intercourse after THA have not been broadly discussed in the literature. In four countries (USA, UK, Switzerland and The Netherlands) expert opinions were gathered regarding safe sexual positions and the postoperative sexual "time out" for THA patients before resuming sexual activity [26, 33-35]. However, no unanimous opinion was found. In our study, less than half of the THA surgeons, recommended a waiting time of 6 to 8 weeks (30–40%), probably keeping the estimated formation of the neo capsular tissue in mind [52]. Based on the surgeons' responses, no consistent view could be derived. Charbonnier and colleagues were the first who, based on virtual collision stimulations, studied the relative risk of impingement and joint instability during 12 sexual positions. They took the mechanical relationships of the prosthetic parts into account. Charbonnier et al., particularly focused on the acetabular component, while leaving out the influence of muscles, ligaments, and capsules. More detailed motion research is lacking. In our study, only 50% of the THA surgeons agreed with the findings of Charbonnier. The other half stated that there were no restrictions at all. As such, we did not get a uniform advice. Hence, more motions studies are necessary in order to develop national guidelines, that can be used to inform sexually active patients in a more consistent way. Until then, surgeons are advised to inform their patients about the lack of an expert opinion agreement, since it seems that patients are not always aware of the risks.

For TKA patients, surgeons agreed that there were no restrictions when resuming sexual intercourse. Surgeons had the opinion that after TKA kneeling or squatting could be inconvenient during some sexual positions (i.e., one position for men: position 3; and three positions for women: position 3, 10 and 11). Following a standard knee replacement, knee flexion usually is about 115 degrees (which always is less than a normal knee). Postoperative flexion is determined by the preoperative flexion, which is widely known in orthopedic research [53]. However, it is unclear if reduced flexion of the artificial knee has been recognized by patients as an important factor of impairment when regaining sexual activity after TKA. It

is expected that couples will not be aware of limitations in these positions, until they experience unexpected discomfort during sex. This may be due to either the unexpected limited knee flexion and/or dysesthesia but also of the anterior knee scar. Thus, surgeons should inform their (sexually active) patients sufficiently and patients should expect moderate outcomes with respect to the decreased kneeling function after surgery [29, 30]. Furthermore, women who expect to regain their preferred sexual position 10 and 11 postoperatively may be disappointed after surgery. Since some sexual positions require women to be able, to deeply bend their knees as deep bending of the knees will not be possible anymore [53]. Hence, explicit patient information is important, to prevent these unexpected limitations in positions and to manage expectations [31, 32]. In our study, half of the surgeons felt no need to develop TKA patient information. We suggest that this is because there is still scant attention in literature on TKA patients' sexual activity.

In the study of Wall, 12% of the partners felt fear of hurting their spouse [26]. Also, Yoon et al. published this finding [11], whereas in our study, one partner experienced this fear of hurting his wife. When discussing safety measures during our interviews, couples became aware and felt that they would have liked to know more about when and how to resume sexual positions, which is in line with literature [11–14, 26, 54]. However, surgeons seem to avoid the subject [34]. Our couples did not understand why essential information about sex after surgery had not been provided by the surgeon. Written information should consist of practical information about (for TKA) uncomfortable and (for THA) permitted positions. This encourages "faithful trust" in surgeons and nurses [55] and will foster an open communication culture.

Strengths and Limitations

Sexual activity is an important part of quality of life in THA and TKA patients [24, 56] and this study reveals that there is a gap between the patients' and surgeons' need of clear communication. The use of the 12 Dahm-drawings of sexual positions as tool to discuss with surgeons how they would advise patients and to ask couples about potential changes in their preferred sexual positions facilitated the discussion during the interviews and enhanced interpretation afterwards [57, 58]. This pilot study can be seen as a first step in exploring qualitative issues of sexual activity in TKA and THA couples. Data saturation was achieved. All five couples gave the same narrative story and similar themes were distracted from the interviews.

This study has some limitations. Firstly, the interviews took place around 1.5 years after surgery. A correct reconstruction of the pre- and postoperative period was not always possible. Secondly, we interviewed a selective and small group of patients. The level of non-participation was high. All participating couples did not hesitate to talk about sexual activity. It could be that because of these attitude and communication skills, these couples were also better in coping and adapting to new circumstances naturally. This finding should be kept in mind when new qualitative research on sexuality is designed [59, 60]. On the contrary, we invited couples to talk about sensitive topics. This could be an important reason for declining participation [61]. If we had chosen to interview patients without their partners, probably more persons would have been inclined to participate in this study. However, we were interested in the perspectives of sexually active couples. We realize that this choice gave us a selective group, resulting in selection bias. Due to the study design and eligibility criteria, important issues and perspectives of patients and partners may have been missed.

Conclusions

All couples physically and mentally adapted to the new situation and resumed sexual activity after surgery without considering or incorporating safety measures. Patients trusted their surgeons in their role as provider of necessary information. Thus, surgeons should be aware that patients expect their surgeon to inform them succinct about regaining sexual activity. This study emphasizes the importance of more explicit information on sexual activity during outpatient consultations. This will also add to more realistic patients' expectations of sexual activity.

The latter is even of more importance since the surgeons' recommendations showed great variability. More motion research on hip and knee, may add to a more uniform postoperative advice after THA/TKA surgery.

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 If you both look back, can you remember how often you had intercourse? Can you indicate whether this was less than before OA started (What was your "normal pattern" when you did not have a worn hip/kne Can you recall what a worn hip/knee does to developing a desire for sex? Looking back, to what extent did sex (quality of intercourse) with a worn hip/knee plav a role in getting
- Looking back, to what extent did sex (quality of intercourse) with a worn hip/knee play a role in getting the surgery (faster)? Is there anything from that period of "worn hip/knee" and "sex" that is important to

Objectives	Questions used in the semi structured interview
Research objective 2 To explore what having a prosthesis (hip/knee) means for the sex life of patients and their partners	 Can you say anything about how it went the first time with the new hip/knee? How soon after surgery (number/month week)? Can you tell us something about the influence a new hip or knee has on the desire for sex? To what extent has sex improved after the operation? For the partner: What did it mean for you to have intercourse with your partner who has a hip/knee replacement? For all patients (active and not active) Can you say something about the influence of time (age) on your sex life (intercourse)? Can you say something about the influence of time (age) on your sex life (intercourse)? Can you say something about whether your sexual relationship has changed because of hip/knee surgery? Can you say something about how important having intercourse is to you?
Research objective <i>3</i> To explore if there is a change in the (preferred) sexual positions	 Questions for both Which position(s) do you prefer? (use drawings to point out); before and after surgery. Can you tell something about your choice; If they have changed, why? If the favorite position is no longer possible, what does this mean and why can't you do it? How does that affect you? Were there other reasons why you have changed your favorite position? Can you tell us something about your thoughts and feelings of being safe during intercourse? And about your expectations on that point?
To explore the moment of resuming intercourse	- When exactly did you think you were ready for engaging in sexual intercourse? (number of weeks/months after the operation); Can you tell us what that moment was based on?
Research objective 4 To explore the need for communication, information and/ or instruction	- Regarding the need for information: Can you tell what you would like to know, to feel well informed and prepared? And what role do you see for yourself and or your partner to ask for? What information do you need as a partner? Providing information by whom? Can you tell something about the need for instruction e.g., for the leg position?

Part II

Perspectives of Total Hip Arthroplasty and Total Knee Arthroplasty Surgeons


Chapter 6

Patient Sexual Function and Hip Replacement: A Survey of Surgeon Attitudes

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Purpose

To explore practices of orthopaedic surgeons (and residents) in addressing sexual function (SF) in patients before and after total hip arthroplasty (THA).

Methods

A 26-item questionnaire was sent to health professionals (n = 849); 526 (62.0%) responses were included in the analyses.

Results

About 78% of the respondents (77.5%) almost never addressed SF. The most mentioned reason was that "patients don't ask" (47.4%) followed by "I am not aware of possible needs" (38.6%). SF was even less discussed (25.9%) in elderly patients (> 60 years). The beneficial effect of THA on SF was rated the highest in retired surgeons ($p \le 0.001$), in which male surgeons scored higher than female surgeons (p = 0.002). The importance of sexual difficulties (SD) in the decision to undergo surgery was rated lowest by residents (p = 0.020). Rating the risk for dislocation varied between occupations (p = 0.008) and gender (p = 0.016), female surgeons rated highest (median 5); 54.1% indicated the orthopaedic surgeon is responsible for providing information about the safe resumption of sexual activity.

Conclusions

Surgeons show little attention to SF related issues in THA patients, which seems not in accordance to patients' needs. Addressing SF increases throughout a surgeon's career. There were divergent views and there is no "common advice" about the safe resumption of sexual activity. The results emphasize the need for guidelines and training in order to encourage addressing SF both, before and after THA.

Introduction

Each year more than one million patients worldwide undergo total hip arthroplasty (THA) for symptomatic hip arthritis (HA) [1]. Lavernia et al. (2015) found that HA interfered with sexual function (SF) in 82% of THA patients (mean age 65; range 20–89). Authors suggest SF should be routinely addressed with all patients undergoing THA [2]. Within fifty year of research, only few studies have examined the impact of HA on SF and improvement of SF after THA [3–9]. Since 1991, Stern et al. (1991) found that nearly 80% of patients (who were satisfied with the THA result) felt the need for more information about SF afterwards; and in 20% sexual dysfunction (SD) had been an argument to undergo THA [4].

To our knowledge, there are only two studies published addressing SF in THA patients [7, 10]. However, these studies are small with less attention for specific views on patients' perspectives and safety matters.

In this context, the objectives of this study were to explore: (i) practices of orthopaedic surgeons in addressing issues of sexual function (SF) in patients before and after total hip athroplasty (THA), (ii) surgeons' views on patients' perspectives of SF related issues, and (iii) surgeons' opinions on safe return to sexual activity after THA. Differences between the surgeons' gender and occupations (residents, practicing surgeons, teaching-practicing, and retired surgeons) are of interest, in order to provide useful information to encourage communication about SF in future daily orthopaedic practice.

Methods

We conducted a cross-sectional survey among a group of orthopaedic surgeons with detailed measurements of SF related issues. We collected surgeons' opinions on patient perspectives, communication, and questions about safety matters, especially related to the safe resumption of sexual activity after THA and the surgical technique.

Development of Questionnaire

A 28-item Dutch questionnaire was developed by a urologist (HE) for questioning medical disciplines; and previously used in cardiology, radiotherapy, oncology, nephrology [11–15].

This questionnaire was modified for use in orthopaedic practice by three authors (RH, PN, TH), and piloted on eight orthopaedic surgeons, five retired surgeons and 12 residents. Two questions were removed. It covers demographic questions (questions 1–7) and questions on the three objectives: (i) surgeons' views on patients' perspectives of SF related issues (questions 8–11); (ii) surgeons' practices in addressing SF issues and perceived barriers to communication (question 12–16); and (iii) surgeons' opinions on safe return to sexual activity after THA (question 17–22). Finally, there were some additional questions (questions 23–26). An in English translated version can be found in Appendix 1.

Surgeons and Procedure

The 26-item modified questionnaire was posted to practicing orthopaedic surgeons performing hip surgery (n = 455), retired orthopaedic surgeons (n = 149), and orthopaedic residents (n = 245) in the Netherlands. Addresses were retrieved from the member list of the Netherlands Orthopaedic Association (Nederlandse Orthopedische Vereniging, NOV). After screening on "performing hip surgery" and "living in the Netherlands" 849 addresses were retrieved. Two reminders were sent after 6 and 12 weeks. Data were collected and analysed anonymously. For research not involving patients, approval from an ethical board is not required in the Netherlands. Figure 1 shows the procedure for the selection of eligible respondents and response rates.

Statistical Analysis

Statistical analyses were performed using IBM SPSS, version 22 for Mac/Windows. Most responses were scored on a visual analogue scale (VAS) ranging from no effect (1) to the strongest possible effect (10). For some questions an 'I don't know' option was available which was coded as '0' in the analyses.

The results are presented using descriptive analyses. Continuous variables were found to be not normally distributed and are therefore summarized as median (interquartile range IQR). Distributional differences between the occupations and genders were tested using Pearson's chi-squared tests or Mann-Whitney tests and Kruskal-Wallis test. Missing data were excluded from the percentage calculations; p-values of < 0.05 were considered to be statistically significant.



Figure 1: Flowchart of the Study Procedure.

Results

Of the 849 questionnaires sent out, 600 (70.7%) were returned. Of these, 74 respondents chose not to participate in the study. Reasons for non-participation were: no longer actively performing surgery (n = 43; 58.1%), lack of experience (n = 21; 28.4%), not relevant (n = 6; 8.1%), not interested (n = 3; 4.1%), and no time (n = 1; 1.4%). In total 526 respondents were included in the analysis (62.0%). The surgeons' demographics are summarized in Table 1.

Table 1: Characteristics of the Respondents

	"Overall" n = 526 (100%)	Practicing surgeons n = 326 (52%)	Residents n = 123 (23.4%)	Retired surgeons n = 77 (14.6%)
Cohort information	n (% of total)	n (% of total)	n (% of total)	n (% of total)
Gender				
Male surgeons	467 (88.8)	300 (92.0)	90 (73.2)	77 (100)
Female surgeons	59 (11.2)	26 (8.0)	33 (26.8)	
Age groups				
20-30 year	32 (6.1)	1 (0.3)	31 (25.2)	-
31–40 year	192 (36.5)	100 (30.7)	92 (74.8)	-
41–50 year	97 (18.4)	97 (29.8)	-	-
51–60 year	89 (16.9)	88 (27.0)	_	1 (1.3)
61–70 year	79 (15.0)	36 (11.0)	_	43 (55.8)
> 70 year	37 (7.0)	4 (1.2)	_	33 (42.9)
Type of hospital/clinic				
University	60 (11.4)	16 (4.9)	36 (29.3)	8 (10.4)
General teaching	224 (42.6)	121 (37.1)	70 (56.9)	33 (42.9)
Regional/district	193 (36.7)	154 (47.2)	5 (4.1)	34 (44.2)
Specialized/ private	43 (8.2)	33 (10.1)	8 (6.5)	2 (2.6)
≥ 2 clinics	6 (1.1)	2 (0.6)	4 (3.3)	-
Experience				
0–11 months	25 (4.8)	4 (1.2)	21 (17.1)	_
1–2 year	61 (11.6)	10 (3.1)	51 (41.5)	_
3–5 year	108 (20.5)	59 (18.1)	49 (39.8)	_
6–10 year	70 (13.3)	70 (21.5)		
11–15 year	58 (11.0)	58 (17.8)	_	_
15–25 year	78 (14.8)	66 (20.2)	2 (1.6)	10 (12.8)
> 25 year	125 (23.8)	58 (17.8)	_	66 (87.0)
"Retired"	1 (0.2)			1 (0.2)
Number of THR performed per year	· · ·			()
< 50	198 (37.6)	70 (21.5)	114 (92.7)	14 (18.2)
50-100	214 (40.7)	172 (52.8)	9 (7.3)	33 (42.9
100-200	96 (18.3)	71 (21.8)	_	25 (32.5)
> 200	18 (3.4)	13 (4.0)	_	5 (6.5)
Surgical technique	· · /	~ /		()
Posterior/postero-lateral	313 (59.5)	204 (62.6)	69 (56.1)	40 (51.9)
Anterior/anterolateral	63 (12.0)	42 (12.9)	11 (8.9)	10 (13.0)
Direct lateral	104 (19.8)	62 (19.0)	22 (17.9)	20 (26.0)
Various (≥ 2)	46 (8.7)	18 (5.2)	21 (17.1)	7 (9.1)

THA (total hip arthroplasty)

Views on Patients' Perspectives of SF related Issues

Table 2A shows the respondents' views regarding four questions: (i) the impact of HA on SF, (ii) improvement of SF after THA, (iii) the importance of SD in the decision to undergo surgery, and (iv) the need for information on the safe resumption of sexual activity. To each of those four questions, approximately 10% responded with "*don't know*" (range 7.0–13.5%). The beneficial effect of THA on SF was rated the highest in retired surgeons ($p \le 0.001$), in which male surgeons scored higher than female surgeons (p = 0.002). The importance of SD in the decision to undergo surgery was rated lowest by residents (p = 0.020).

Opinions on a Safe Return to Sexual Activity after THR.

Table 2B shows surgeons' opinions about six factors considered to be of influence in patients' safe resumption of intercourse. Approximately 3% of the respondents did not answer to all questions (missing range: 5–34). Compared to all categories of orthopaedic surgeons, residents thought more often that "age" influences safe resumption (p = 0.001). For peroperative stability the distribution differed between the occupations (p = 0.001), although the medians were equal.

Rating the risk for dislocation within the first three months, 69 chose the option "I don't know" (13.1%). The total cohort rated the risk at median 3 (IQR 2–6). The rating varied widely between occupations: median for practicing surgeons: 3 (IQR 2–5); for residents: 4 (IQR 3–6); and for retired surgeons: 4 (IQR 2–6.50) (p = 0.008), and also across gender: males: 3 (IQR 2–5); females: 5 (IQR 3–6.50) (p = 0.016).

Overall, 7.4% (n = 39) reported knowledge of patients who had experienced dislocation caused by sexual activity; a further 5.5% (n = 29) suspected this. One third (33.1%; n = 174) indicated that resuming was advisable whenever the patient felt ready. This was most often advised by surgeons who practised an anterior approach (48.4%) compared to those who performed a posterior (32.3%) or direct-lateral approach (29.8%) (p = 0.024). Recommendation to wait six to eight weeks after surgery was responded by 42.5% (n = 223/525) (p = 0.008). In case of peroperative instability of the implant, 19% would address precautions on safely resuming; 39.7% of respondents would do so only when patients would ask for. 6

	P value	Between gender ##	0.644	0.002		0.433		0.455
	n group)	Female surgeons (n = 59)	57 (96.6) 7 (6-7)	54 (91.5) 6 (5-7)	53 (89.8)	4(3-5)	56 (94.9)	7 (5–8)
	n (% withiı	Male surgeons (n = 467)	425 (91.0) 7 (5-7)	426 (88.8) 7 (6-8)	402 (88.4)	4 (3-6)	433 (88.5)	7 (5–8)
	P value	Across occupation #	0.924	≤ 0.001		0.020		0.335
		Retired surgeons (n = 77)	60 (77.9) 6.5 (5–8)	62 (80.5) 8 (6–8)	56 (72.7)	4.5 (3-7)	68 (88.3)	7 (5–8)
	group)	Residents (n = 123)	115 (93.5) 7 (6-7)	115 (93.5) 6 (5-7)	114 (92.7)	3 (3–5)	118 (95.9)	7 (5–8)
	n (% within	Practicing surgeons (n = 326)	307 (94.2) 7 (5-7)	303 (92.9) 7 (6–8)	285 (87.4)	4 (3-6)	303 (92.9)	7 (5–8)
ed issues		(n % of total)	482 (91.6) 7 (5-7)	480 (91.3) 7 (6–8)	455 (86.5)	4 (3-6)	489 (93.0)	7 (5–8)
A. On patients' perspectives of SF relate		Total cohort $(n = 526)$	Rating the impact of HA on SF* <i>Median (IQR)</i>	Rating improvement of SF after THA* <i>Median</i> (IQR)	Rating the influence of SD in patients' decision to undergo THA*	Median (IQR)	Rating patients' need for information on safely resuming*	Median (IQR)

Table 2. Surgeons' Views and Opinions

B. On matters of safe return to sexual	l activity **							
Factor "Age"	500 (95.1)	309 (94.8)	118 (95.9)	73 (94.8)		444	56	
Median (IQR)	4(1-7)	3 (1-7)	6 (2-7)	4(1-7)	0.001	3.5 (1-7)	5 (1.25–7)	0.906
Factor "being Male"	492 (93.5)	305 (93.6)	115 (93.4)	72 (93.5)		435	57	
Median (IQR)	3 (1-6)	3 (1-5)	4 (2-6)	4(1-7)	0.156	3 (1-6)	5 (2-6)	0.145
Factor "being Female"	496 (94.3)	307 (94.2)	117 (95.1)	72 (93.5)		437	59	
Median (IQR)	4(1-7)	4 (1-7)	5 (2-7)	4(1-6)	0.309	4 (1–7)	5 (3-7)	0.182
Factor "surgical technique"	506 (96.2)	315 (96.6)	119 (96.7)	72 (93.5)		449	57	
Median (IQR)	7 (4-8)	6 (3-8)	7 (5–8)	7 (5–8)	0.252	7 (3–8)	7 (5–8)	0.556
Factor "stability peroperative"	508 (96.6)	315 (96.6)	120 (97.6)	73 (94.8)		450	58	
Median (IQR)	8 (6–9)	8 (5-8)	8 (6–8)	8 (7–9)	0.001	8 (6–9)	8 (6–8)	0.309
Factor "Patients' knowledge which movements to avoid"	521 (99.0)	323 (99.1)	123 (100)	75 (97.4)		462	59	
Median (IQR)	8 (7–9)	8 (7–9)	8 (8–9)	8 (6–9)	0.008	8 (7–9)	8 (8–9)	0.025
A: * Between 7–13.5% of surgeons chose B: **Not all respondents filled in all six f Abbreviations: HA hip arthritis, SD sexu ## Mann Whitney U test.	e option "don't ki actors. These (3 aal difficulties; S	now (resp. 8.4 %) missing da F sexual funct	%; 8.7%; 1.5% ta were excluc tion; THA (to	; 7.0%). led from the tal hip arthr	percentage calc pplasty); IQR (i	culating. nter quartile ra	ange). # Krusk	al-Wallis test;

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Perceptions of Barriers to Communication

Table 3 summarizes the responses towards communication. Retired surgeons had addressed SF more often (41.8%) compared to residents (4.9%) and practicing surgeons (24.8%) ($p \le 0.001$). We asked respondents who rarely address SF, to rank three out of eleven possible barriers. The most mentioned barrier was that "patients don't ask" (47.4%) followed by "I am not aware of possible needs" (38.6%).

Almost 90% (n = 467) of the respondents reported that in discussing SF, patients' gender is not relevant. Of the 56 respondents who thought that gender could be an issue, discussing SF with female patients was perceived as more difficult in 8.6% (45/523) than with male patients (2.1%). Distribution on gender showed that in addressing SF, 9.5% (44/464) of male surgeons perceived female patients as more difficult, whereas 8.5% (5/59) of female surgeons perceived male patients as more difficult.

Addressing SF with senior patients > 60 years of age was considered to be difficult in 25.9% (135/522): residents scored highest (44.3%; 54/122) compared to practicing surgeons (23.8%; 77/324) and retired surgeons (5.3%; 4/76) ($p \le 0.001$). Female surgeons (37.3%) were less inclined to discuss SF with patients > 60 years compared to male surgeons (24.4%) (p = 0.103).

A total of 284 (54.1%) respondents indicated that the orthopaedic surgeon was primarily responsible for addressing SF with patients before and after THA. Residents more often suggested nurse practitioners were responsible (19.5%) than did orthopaedic (15.0%) and retired surgeons (11.8%) (p = 0.002). The need for additional training in addressing SF was reported by 52.1% of respondents ($p \le 0.001$). Twenty-six percent did not consider SD as a relevant issue for hip patients in their practice, and 32.1% did not know (p = 0.026). Over half of respondents (55.1%) agreed that PROM questionnaires should include SF (p = 0.013).

A. Surgeons' addressing SF								
		n (% within	occupation)		P value	n (% withir	n gender)	P value
Cohort size $(n = 525) *$	n (%) of total	Practicing surgeons	Residents	Retired surgeons	across occupation #	Male surgeons	Female surgeons	between gender #
(almost) Never In < 25–50% of patients	407 (77.5) 96 (18.3)	245 (75.2) 68 (20.9)	117 (95.1) 5 (4.1)	45 (59.2) 23 (30.3)	≤ 0.001	353 (75.8) 91 (19.5)	54 (91.5) 5 (8.5)	0.093
In 50% of patients	8 (1.5)	4 (1.2)	1 (0.8)	3 (3.9)		8 (1.7)	,	
In > 50-75%	7 (1.3)	5 (1.5)	ī	2 (2.6)		7 (1.5)	ı	
(almost) Always	7 (1.3)	4(1.2)	I	3 (3.9)		7 (1.5)	ı	
B. Barriers to communication: $n = 407$ (§	given as first r	cason) **						
Patients don't ask	193 (47.4)	117 (47.8)	46 (39.3)	30 (66.7)	0.130	168 (47.6)	25 (46.3)	0.790
I am not aware of possible needs	157 (38.6)	95 (38.8)	52 (44.4)	10 (22.2)		132 (37.4)	25 (46.3)	
It's a (too) delicate issue for me	12 (2.9)	4(1.6)	7 (6.0)	1 (2.2)		10 (2.8)	2 (3.7)	
It's not relevant for orthopaedic patients	8 (2.0)	5 (2.0)	1(0.9)	2 (4.4)		8 (2.0)		
I'm not trained for that	8 (2.0)	4(1.6)	4(3.4)	,		8 (2.3)		
I don't think it's necessary	10 (2.5)	6 (2.4)	4(3.4)			9 (2.5)	1(1.9)	
There's no time for that	7 (1.7)	4(1.6)	2 (1.7)	1 (2.2)		6 (1.7)	1(1.9)	
I'm concerned patients will	5 (1.2)	4(1.6)		1 (2.2)		5(1.4)		
misunderstand that								
Not part of my job	1 (0.2)	1(0.4)	ı			1(0.3)		
For reasons related to culture, language,								
religion or ethnicity								
Other reasons	6(1.5)	5 (2.0)	1(0.9)	,		6 (1.7)		

Patient Sexual Function and Hip Replacement: A Survey of Surgeon Attitudes

Discussion

Surgeons show little attention to SF related issues in their THA patients. However, attention increases throughout career. We found divergent views and no "common advice" about safe resumption of sexual activity. Advice seem independent to surgical approach. Respondents rated the risk for dislocation during SA rather low.

Limitations and Strengths of the Study

The questionnaire was not psychometrically tested before use; this may have led to some shortcomings in validity and reliability, variables could have been misunderstood due to lack of formulating definitions. We suggest there were missing values for this reason in question 17 (3%). Not all respondents filled in second and third reasons (question 13). We, therefore, chose to analyse the first reason, only. Secondly, the cohort study is probably not generalizable. Sex-related issues are sometimes a 'taboo' topic for some cultures, considering that this activity may be seen as forbidden or sacred based on religious beliefs or morals. Therefore, the results should be considered as best-case estimates, not applicable to other populations.

Nevertheless, overall, this study contains very few missing values. Despite the inevitable risk of response and information bias, this study offers a high response rate, especially for this type of (sensitive) investigation. Furthermore, it benefits from a broad overview among attitudes and views of orthopaedic surgeons to SF related issues in THA patients, per occupation as well as per gender.

Addressing SF was difficult for 77.5% of the respondents and this finding is in line with the two available, previous studies: in the UK 69.0% [7] and in the USA 80.0% [10]. However, we found that retired surgeons had addressed SF more often (40.8%) than residents (4.9%), practicing surgeons (24.8%), and female surgeons were less inclined to address SF (91.5%) as compared to their male colleagues (75.8%). That was a somewhat unexpected finding in view of previous research: Birkhoff et al. (2016) found that female physicians address a taboo topic (as sexual abuse) more frequently than do their male colleagues [16], and Bertakis (2009) reports about a more devoted attitude in female physicians (internal and general) spending more time to psychosocial counselling compared to their male colleagues, who were more technically oriented [17]. Although communication about SF in orthopaedic literature is limited [18], the importance of effective communication skills in the patient-doctor relationship is widely recognized [19].

We looked for barriers in communication. Although the most cited reason was because patients are not initiating SF issues themselves; the patients' age (>60years) was of influence too (25.9%). Interestingly, the factor *no time* was not indicated to be important (1.7%) compared to approximately 40% of respondents in other areas of medical disciplines [11, 13, 14, 16]. It has been noted that patients do not raise the subject spontaneously [20]. We suggest surgeons should find effective standardized ways to provide "easy" communication about SF in their practices.

In an earlier systematic review, we published about improvements of sexual activity after THA ($\Delta 0-77\%$); and the patients' need for more advice (range 57–89%) [18]. For 20% of the patients, SF appears to be an argument to undergo THA [4, 6]. It is important to know patients' needs, motives and expectations about SF, and before starting the surgical procedure. Especially, since literature suggests that unfulfilled expectations will lead to dissatisfaction [21]. Even more, several studies indicate that some patients (2–17%) never resume sexual activity again after THA [6, 9, 22, 23]. It seems to be highly important to have better insights into the determinants of SF in THA patients.

The patients' fear for dislocation has been emphasized (up to 80%) in previous literature [8]. In addition, these female patients changed their preferred sexual positions after THA in non-recommended positions, mostly due to difficulties with the leg position [8]. Unknown is if this would lead to more dislocations of the prosthesis more easily. We had expected to find an association between the preferred technique and the surgeons' advice concerning the waiting time before resuming intercourse, however, we did not. One third of the respondents indicated that resuming was permitted whenever the patient felt ready, and this was unrelated to the surgical technique. This seems in line with a recent review stating that "a more liberal lifestyle restrictions and precautions protocol will not lead to worse dislocation rates, but instead will lead to earlier and better resumption of activities and higher patient satisfaction" [24].

To the best of our knowledge there are no studies focused on dislocation caused by intercourse and positions. Compared to 20% (n = 254) of the USA surgeons [10], in our study a surprisingly low proportion of the respondents reported being aware of at least one patient experiencing THA dislocation during sexual activity (7.4%). Only one study has determined –theoretically, based on MRI, 3D studies, and animations- which sexual positions pose the greatest risk for impingement and thus for dislocation of the prosthesis [25]. Notwithstanding this, we asked surgeons if they would inform the patient about the risk for dislocation during sexual activity, in case they noted during surgery that the stability of the prosthesis was suboptimal. Previous literature suggests that, in the event of instability patients should be informed about which sexual positions to avoid [1]. However, more than two thirds of respondents stated they would not inform the patients, or only if patients were to ask about it. Obviously, the majority of respondents reported that they routinely provide their patients with general information how to prevent dislocation; probably supposing their patients can translate this into knowledge about safe sexual positions themselves. Therefore, it remains uncertain if indirect information put them into risk. Although, in the 20th century, communication about SF still is difficult (from the perspective of both surgeon and patient), surgeons should look for standardized ways to provide patient-information and tailor-made advice both, before and after surgery. In line with this, we believe that evaluating SF by means of PROMs could help to encourage surgeons to address SF and will shed light on this under-recognized issue in orthopaedic practice.

Conclusions

Despite research, which suggests patients want more information and discussion with their surgeons about SF and hip replacement surgery, the majority of Dutch orthopaedic surgeons surveyed appear to not address this need. Our research did however show that addressing SF increases throughout a surgeon's career. It was also clear that the age of both, the surgeon and patient influence this discussion. Surgeons' views were divergent and there was no "common advice" about safe resumption of sexual activity. The results emphasize the need for further research and guidance for surgeons and their team in order to encourage addressing SF both, before and after THA.

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Appendix

If you do not wish to fill in this questionnaire, please indicate why:

- I don't perform hip surgery
- Not relevant
- No time
- Not interested
- o Lack of experience
- o Overly sensitive issue
- o Other reason, namely...

PERSONAL INFORMATION

- 1. What is your gender?
 - 0 Male
 - 0 Female
- 2. What is your age?
 - 0 20-30
 - 0 31-40
 - 0 41-50
 - 0 51-60
 - 0 61-70
- 3. What is your occupation?
 - 0 Orthopaedic surgeon
 - 0 Resident
 - 0 Orthopaedic surgeon/educator
 - 0 Retired orthopaedic surgeon
- 4. How many hip operations do you perform each year?
 - 0 Fewer than 50
 - 0 Between 50 and 100
 - 0 Between 100 and 200
 - 0 More than 200

- 5. What is your surgical approach?
 - 0 Posterior
 - 0 Anterior
 - 0 Direct-lateral
 - 0 Other, namely.
- 6. Where do you (mainly) perform surgery?
 - 0 Academic hospital
 - 0 General teaching hospital
 - 0 Regional or district hospital
 - 0 Specialized or private clinic
- 7. How long have you been performing total hip replacement (THA) surgery?

0	0–11 months	0	6-10 years
0	1–2 years	0	11-15 years
0	3–5 years	0	15-25 years
		0	> 25 years

PATIENTS PERSPECTIVES

- How would you rate the impact of hip arthritis (HA) on patients' sexual function (SF)?
 (1 = not important; 10 = extremely important)
 - <u>1 2 3 4 5 6 7 8 9 10</u> 0 I don't know
- How would you rate the beneficial effect of total hip arthroplasty (THA) on SF? (1 = none, 10 = extremely high)

<u>1 2 3 4 5 6 7 8 9 10</u> 0 I don't know

10. How would you rate the importance of patients' desire to improve their sexual function (SF) in their decision to undergo surgery?

(1 = not important, 10 = extremely important)

1 2 3 4 5 6 7 8 9 10

0 I don't know

11. How would you rate the need for information on the safe resumption of sexual activity?

(1 = no need, 10 = extremely high need)

0 I don't know

COMMUNICATION

- 12. Do you discuss questions concerning SF in patients with HA and after THA?
 - 0 Rarely/never
 - 0 With fewer than 25-50% of patients
 - 0 With around 50% of patients
 - 0 With more than 50–75% of patients
 - 0 (Almost) always
- 13. If you "rarely or never" discuss questions concerning SF with patients, what is the reason for this? Please rate the most important three factors, with 1 as the most important.
 - 0 I am not aware of possible needs
 - 0 Patients don't ask
 - 0 It's not part of my job
 - 0 There's no time for it
 - 0 It's a too delicate issue for me
 - 0 I don't think it's necessary
 - 0 I'm not trained for that
 - 0 I'm concerned patients will misunderstand that
 - 0 It's not relevant for orthopaedic patients
 - 0 For reasons related to culture, language, religion or ethnicity
 - 0 Other reason, namely.....
- 14. In discussing SF issues, does the patient's gender make a difference?
 - 0 No, gender makes no difference
 - 0 Yes, I find it more difficult to discuss this with women
 - 0 Yes, I find it more difficult to discuss this with men
- 15. In discussing SF issues, does the patient's age make a difference?
 - 0 No, age makes no difference
 - 0 Yes, I find it more difficult to discuss this with senior people (60+)
 - 0 Yes, I find it more difficult to discuss this with younger people (under 60)

6

- 16. In your opinion, who is responsible for answering patients' questions about resumption of SF after THA?
 - 0 Orthopaedic surgeon
 - 0 General practitioner
 - 0 Nurse practitioner/physician assistant
 - 0 Physiotherapist
 - 0 Nobody
 - 0 Other, namely

SAFETY MATTERS

- 17. Please indicate, on a scale from 1–10, which of the factors below matter in relation to the safe resumption of sexual activity after THA? (1 = not important, 10 = extremely important)
 - 0 Age <u>1 2 3 4 5 6 7 8 9 10</u>
 - 0 Male patient <u>1 2 3 4 5 6 7 8 9 10</u>
 - 0 Female patient <u>1 2 3 4 5 6 7 8 9 10</u>
 - 0 Surgical approach 1 2 3 4 5 6 7 8 9 10
 - 0 Peroperative stability <u>1 2 3 4 5 6 7 8 9 10</u>
 - 0 Knowledge of movements to avoid <u>1 2 3 4 5 6 7 8 9 10</u>
- 18. How would you rate the risk of dislocation when resuming sexual activity within the first three months after the operation? (1 = no risk, 10 = extremely high risk)
 - <u>1 2 3 4 5 6 7 8 9 10</u>

0 I don't know

- 19. Do you think information will matters in reducing risks?
 - 0 Yes
 - 0 No

- 20. If the hip is stable and the patient were to ask your advice on when sexuality can be safely resumed, what would your response be?
 - 0 As soon as the patient is ready
 - 0 After 2–4 weeks
 - 0 After 6-8 weeks
 - 0 After 3 months
 - 0 After 6 months
- 21. If patients were to ask your advice on safe positions when resuming sexuality, what would your response be? (Please choose **one** answer that fits best.)
 - 0 I'd refer them to the Internet
 - 0 I'd refer them to a general practitioner
 - 0 I'd refer them to a nurse practitioner/physician assistant
 - 0 I'd refer them to a physiotherapist
 - 0 I'd give them a flyer
 - 0 I'd explain how to prevent dislocation
 - 0 I'd tell them there are no restrictions whatsoever
- 22. If you sense during the operation that stability is suboptimal, would you inform your patient about the risk of dislocation during sexual activity?
 - 0 Yes
 - 0 No
 - 0 Only if patients ask
 - 0 Other, namely.....

GENERAL

- 23. Have you ever come across a patient with a dislocation of the hip caused by sexual activity?
 - 0 Yes
 - 0 Probably, but I didn't ask
 - 0 No
- 24. Do you think questionnaires used for Patient Reported Outcome Measures (PROMs) should include items on SF?
 - 0 Yes
 - 0 No
 - 0 Don't know

- 25. Do you see sexual dysfunction (SD) as a relevant issue for hip patients in orthopaedic practice?
 - 0 Yes
 - 0 No
 - 0 Don't know
- 26. If research were to demonstrate that SD is an important issue for hip patients, would you feel the need for training dedicated to this subject?
 - 0 Yes
 - 0 No



Summary and Perspectives





General Discussion Implications for Clinical Practice Future Perspectives

General Discussion

Aims of the Dissertation

The aim of this thesis was to explore patients' and partners' perspectives on topics of sexual activity after THA and TKA (Part I), complemented by expert opinions of orthopaedic surgeons on the safe resumption of sexual activity after THA and TKA (Part II).

Part I: Perceptions of Patients and Their Partners Introduction

The topic of sexual difficulties in patients with OA of the hip and the effect of total hip arthroplasty (THA) on sexual quality of life were first raised in the literature in the early 1970s, shortly after the introduction of THA [1, 2]. Up to the late 50's, femoral osteotomy or even an arthrodesis of the hip was the treatment of choice for severe end stage OA of the hip [1]. Since then, joint replacement started to revolutionise the orthopaedic health care system [2], although, the issue of sexuality remained barely discussed. As for total knee arthroplasty (TKA), the first studies on sexual activity after TKA are from this millennium [3–6].

Does OA of Hip and Knee and Arthroplasty affect Sexual Activity?

Currey et al. (1970) were the first to publish about OA of the hip joint and the impact of the disease on the sexual relationship of THA patients [2]. They found that of the 121 patients in the study, 67% had experienced some degree of sexual difficulties caused by OA, and that after surgery, sexual difficulties decreased remarkably [2]. Since then, scarce studies have described the impact of OA and hip arthroplasty on sexual activity. In our literature review (**Chapter 2**), we found an improvement in sexual quality of life after THA. However, the results of the studies varied widely. For example, compared to the preoperative phase, a decrease in perceived sexual difficulty (Δ 8–51%) and an increase in sexual frequency (Δ 0–77%) was found. Some studies mentioned patient-reported outcomes, such as an improvement in hip mobility, which had resulted in better overall sexual satisfaction and an improvement in the quality of the sexual relationship (**Chapter 2**). Some studies described postoperative psychological side effects, such as the patients' fear of dislocation [7] and the partners' fear of hurting his wife [8].

Overall, the methodological quality of the studies was low (in ten studies) to moderate (in two studies). Studies mainly had numerous sources of risk of bias (i.e., statistical bias, selection, information, and recall bias). For instance, statistical bias was observed due to lack of proper statistical analysis or not describing missing values. In addition, most studies were retrospective in design with a high risk of information bias. However, these studies were useful to focus our research question on this thesis [8–10]. Most of these retrospectively designed studies shed light on this research field, such as for the main questions of this thesis [11].

Our literature review yielded no studies on sexual activity before and after TKA. The first TKA study was published 21 days after closing our search period. In 2002, a study aimed to determine the effects of aging on the knee function in general. This study compared the postoperative knee function of TKA patients to age and gender matched controls without previous disorders of knee OA [6]. Of the patients, 67% reported that sexual activity was important to them whereas 87% of the control group described that their knee function was unimpaired during sexual activity [6]. One year postoperatively, controls more often felt unrestricted during sexual activity (86%) compared to TKA (64%). Both groups reported a certain deterioration of the knee function over the course of time. The gap between controls and the TKA-group widened, with four times as many difficulties for the TKA population when activities became more demanding (squatting and kneeling) [6]. Although sexual activity after surgery was not specifically studied, the study findings may implicate that TKA patients may experience difficulties during sexual activity postoperatively. However, it took more than ten years before the first retrospective study evaluated young (< 60 years old) active patients after hip and knee arthroplasty [3]. The purpose of this study was to investigate if surgery had affected THA and TKA patients' sexual activity. Only 1.6% of TKA and 1.3% of THA patients reported not being sexually active as a result of surgery [3]. The second study was published two years later and used a self-developed questionnaire for TKA patients, age range 45–90 years. The aim was to assess if surgery had affected sexual activity due to end-stage knee OA and to evaluate the short- and long-term changes in sexual activity after surgery [4]. Preoperatively, 45% of the sexually active patients reported decreased sexual quality and frequency during sexual engagement. Sexual limitations lasted 17.1 months on average [4]. Half of this group of patients noted that they had to adjust their sexual positions and that they avoided carrying weight on the affected knee. Kneeling was almost avoided by all patients. Postoperatively, 28%, still had to adjust their sexual positions to

accommodate their knee, avoiding positions that placed weight on the knee and 25% had less sex in the first year [4].

In summary, the scarce THA studies (**Chapter 2**) and the lack of available TKA studies made it clear that sexual issues in THA and TKA patients have hardly been investigated since the seventies. It can be concluded that the THA and TKA population is likely to be underinformed in what to expect of sexual activity after elective THA and TKA. Therefore, studying this part of the topic was the primary aim of the next step.

Patients' Preoperative Expectations and Their Fulfilment

Numerous studies have been published on pre- and postoperative expectations in THA and TKA patients [12-46]. Several of these studies used the Hospital for Special Surgery Expectation Survey (HSS) [14, 21, 27, 29, 34, 38, 44, 45, 47–49]. The HSS questionnaire includes items about recovery expectations of daily living after surgery. Sexual activity is one of these items. The HSS has been translated and validated for use for patients with knee and hip replacements in the Netherlands [50] and is longitudinally registered as part of the Longitudinal Leiden Orthopaedics Outcomes of Osteoarthritis Study (LOAS) [51]. LOAS is embedded in the Dutch Arthroplasty Registry [52]. The LOAS data were used to examine to what extent the expectation regarding sexual activity in THA and TKA patients were fulfilled after surgery (Chapters 3 and 4). In line with the literature [22, 29, 34, 38, 45, 48], we found a high percentage of unfulfilled expectations: >40% for both THA and TKA. One study, performed by Tilbury et al., also used the HSS and LOAS data [45]. However, this study found lower percentages, 15.6% of unmet expectations postoperatively in THA and 24.8% in TKA patients. These discrepancies may be explained by the difference in samples (2016 versus 2018 and 2019), sample sizes, and the loss to follow up, which exceeded 50% for both pre- and postoperative questions regarding sexual activity [45]. In our study, we decided to exclude data from participants who did not complete both questions and found a bigger difference of numbers of unmet expectations. However, as in the study of Tilbury et al., we also found that in 20% of the patients the expectation regarding sexual activity exceeded [45].

We assumed that for patients the subject of sexual activity received less emphasis when other important targets of THA and TKA, such as relief of pain and improved walking ability during rehabilitation are not yet achieved. In our studies, for both THA and TKA, postoperative fulfilment of sexual activity expectation was also associated with the preoperative functional and health status of the patient. Furthermore, for THA, higher age was inversely associated in men and women (**Chapter 3**), while for TKA, the preoperative health status (EQ5D-VAS) was associated with a higher likelihood of fulfilment (**Chapter 4**).

Patients' expectations are strongly related to patient satisfaction after a treatment, which seems obvious [53]. However, as for hip and knee arthroplasty surgery still up to 15–20% of patients are not satisfied with the result [54]. Preoperative discussing patients' expectations during consultation is essential to manage realistic expectations of the postoperative outcome. Mancuso et al. (2008) showed that expectations can be modified during an educational program aimed to provide information about the immediate perioperative period [31]. As a consequence, patients had expectations that coincided with surgeons' recommendations. Education may help patients to rethink expectations of possible outcome [55]. Preoperatively discussing the items of the HSS, during consultation with the surgeon, was the original goal of the HSS [17]. We suggest that surgeons discuss the patient's preoperative expectations, including sexual activity before surgery. Furthermore, the position of the partner is easily overlooked in questionnaires about sexual activity as well as clinical practice, for that matter an approach of evaluating patients' complaints according to overall functioning [i.e., international classification of functioning, (ICF) of the WHO] is essential in preoperative consultation. For that matter, what patients expect of sexual activity before surgery and whether these expectations can be fulfilled by a (surgical) treatment requires more in-depth qualitative research where all aspects can be explored, if possible, in the presence of the partner. Therefore, an open semistructured interview with sexually active couples was the next step in this research.

Interviews About Patients' and Partners' Perceptions

The study described in **Chapter 5** faced challenges in obtaining a representative sample due to the sensitive nature of discussing sexual issues in sexually active THA and TKA couples. Only five patients and partners out of a group of 150 were willing to be interviewed about the impact of OA and arthroplasty on sexual activity. As a consequence, interviewing a very small group may not reflect the views of the broader population. The reasons for non-participation were collected. It showed that about half of the patients who declined participation were not sexually active, and the other half were sexually active again, but did not want to talk about sex and refused participation.

All participants indicated that they both, physically and mentally, adapted adequately to new situations. The interviewees resumed sexual activity the moment they felt ready, usually within three months. Their frequency of having sex remained the same or higher. Their preferred positions of intercourse changed but were adapted to the new situation, both, before and after surgery. Couples also indicated that they had not been aware of the necessity of taking precautions. They all trusted the surgeon as a provider of necessary information. Since no information was provided about safety measures it did not cross their minds that certain precautions may be needed. The two TKA couples did not experience difficulties as they used positions of intercourse that did not require deep bending or kneeling [4]. One THA couple stated that compared to, for instance distance walking, being sexually active was much more pleasant (and even mostly without pain), because sex was practiced in bed, and did not exert significant strain on the joints. Consequently, our explored material was not in accordance with the review (Chapter 2) or existing literature which often described sexual difficulties, pre- and postoperatively [3, 4, 8-10].

The interviewed couples did not express concerns about dislocation as they were not aware of possible risks [7, 8]. Risks were not explicitly mentioned by their surgeon and were not included in the comprehensive information book they all had received preoperatively. Creating a more open and supportive communication environment in clinical practice could facilitate addressing sexual activity, which is essential for better understanding the challenges of couples before and after total hip or knee replacement surgery.

Exploring these semi-structured interviews about the perspectives of THA and TKA patients and partners should have brought us more insights from the perspective of patients and partners in the main purpose of this thesis. However, the reluctance of participants to engage in the interviews highlights the persisting taboo around this topic [56]. The invitation for partners to join the interviews may have contributed to non-participation as well [57].

Additionally, the small group of patients (3 THA, one of which bilateral, and 2 TKA) did not hesitate to discuss sex together with their partners, creating a selectively, homogenous group of sexually active patients; consequently, a homogeneous picture. Themes were not representative for the population due to the refusal of 90% of the invited couples [56]. Therefore, generalization of the findings to a larger group or the population is impossible. Consequently, the study served as a

pilot study, marking the initial exploration of qualitative issues of a homogeneous group, regarding sexual activity before and after THA and TKA. All seemed relaxed and showed openness in their responses and in interacting during communication about sex, individually, together with the partner, and in the presence of an orthopaedic surgeon (interviewer).

The risk of participants providing socially desirable responses is always present in sensitive interviews [56, 58, 59]. Additionally, bias may arise as individuals may struggle to recall issues that occurred a year and a half ago [10, 56]. Therefore, providing a definitive answer to the research question whether sexual activity in THA and TKA patients was problematic, remains elusive.

Part II: Perceptions of THA and TKA Surgeons

Addressing the sensitive topic of sexual activity is not common in most countries in the world [60, 61], nor it is in most orthopaedic practices [8, 62–64]. However, bringing up this sensitive issue in THA and TKA patients is crucial for comprehensive patient care. To enhance the quality of care in this field, we explored (i) Dutch Hip and Knee surgeons' attitudes towards addressing sexual activity during consultation with patients and partners and (ii) addressed their perspectives regarding safe resumption of sexual activity after hip and knee arthroplasty. In this section, we shed light on this often-overlooked aspect of daily orthopaedic patient care.

Addressing Sexual Activity during Consultation with Total Hip Patients In 2004, Dahm et al., surveyed 821 members of the American Association of Hip and Knee Surgeons in the USA [62] regarding their opinions on appropriate guidelines for safe return to sexual activity after THA. The response rate was 31% (254/821). Most surgeons rarely or never discussed sexual activity with total hip patients. Fifty surgeons (20%) stated they discussed sex regularly during their consultation with patients. Although, 48 surgeons (96%) spent 5 minutes or less [62].

Many years later, in 2016, we decided to replicate this study and ask the same question to surgeons of the Dutch Orthopaedic Hip Society (response rate 62%; n = 526/849). Three-quarters of the cohort (n = 407; 77.5%) (almost) never discussed sexual activity during consultations with patients, whereas nearly all female surgeons did not (n = 54; 91.5%). Contrarily to a study that described that female surgeons would be more likely to discuss sexual activity [65], we found that female surgeons (n = 59; 37.3%) were less inclined to discuss sexual activity with

patients over 60 years old compared to male surgeon (n = 467; 24.3%) (**Chapter 6**). In addition, we explored the most important barriers to communication and surgeons reported two main themes. Nearly half of surgeons (n = 193; 47.4%) reported that patients do not have questions in this area. Consequently, surgeons were not aware of possible needs (n = 157; 38.6%). According to other Dutch medical professional areas, barriers like "I am not trained for that" (n = 8; 2%), "not part of my job" (n = 1; 0.2%), or "there is no time for that" (n = 7; 1.7%) hardly played a role [66–68]. Nevertheless, 25.9% of Dutch orthopaedic surgeons reported difficulty in addressing sexual activity with senior patients (> 60 years of age). Among them residents reported the highest level of difficulty (n = 54/122; 44.3%) and retired surgeons lowest (n = 4/76; 5.3%). Orthopaedic surgeons focus on the functioning of the support and locomotor system and problems experience by patients, such as, pain, function limitation, and loss of movement [69, 70].

Dislocation of the hip prosthesis is a complication that must be prevented with utmost effort, as it is an emotionally and physically very painful, traumatic event for patients [71, 72]. This complication is often caused by a combination of several factors, including patient- and surgeon-related factors, implant design or alignment, and soft tissue factors [72]. The overall incidence rate of dislocation varies in the literature, ranging from 0.2% to 7% after primary THA [73, 74] and from 10% to 25% after hip revision [72]. Dislocation can be prevented with proper patient selection and surgical approach, as well as optimal component selection and orientation [75].

In the Netherlands, outcomes are meticulously recorded by the national arthroplasty register (LROI), which is a comprehensive data registry system maintained by the Netherland Orthopaedic Association (NOV) [73, 74]. However, in case of dislocation, surgeons mostly do not inquire about the possibility that the cause may be relate to improper movements during sexual intercourse. The specific cause of sexual activity as a factor in dislocation is not explicitly registered in the arthroplasty register [76, 77]. Consequently, clear numbers are unknown. The lack of explicit registration of sexual activity as a risk factor for dislocation highlights the need for improved data collection methods, to better gain insights in the incidence.

Chapter 6 shows that, out of a total of 525 Dutch surgeons, 7.4% reported being aware of at least one patient who had experienced dislocation due to sexual activity. Whereas 20 percent of colleagues of the USA surgeons, in 2004, already reported knowledge of patients experiencing dislocation of the implant during sexual activity

[62]. Moreover, the risk for dislocation during sexual activity after THA was rated at a median of 3 [IQR 2-6; VAS scale 1 (lowest) – 10 (highest) by the surgeons. Whereas 13 percent of surgeons (n = 69) answered that they did not know the estimated risk of dislocation. We therefore assume that this might be an underreported problem. Encouraging surgeons to inquire about sexual activity during consultations can contribute to improved patient care and outcomes.

Safely resuming intercourse positions after hip and knee arthroplasty

Despite the fact that yearly in the USA over one million patients undergo arthroplasty (700,000 TKA/400,000 THA) [78–80]; 200,000 in the UK (100,000 TKA/100,000 THA) [81], and around 70,000 in the Netherlands (28,000 TKA/40,000 THA) [73], there is currently no evidence-based guideline available regarding safe intercourse positions after THA and TKA, as well as the appropriate timing for patients to resume sexual intercourse. However, previous studies have examined expert opinions of surgeons about these themes in the UK and in the USA [8, 62]. We sought to investigate the same opinions of Dutch surgeons regarding THA and TKA as well. In Table 1, we documented the results of three studies: the Dutch, the UK, and the USA [8, 62]. This table shows that, compared to the colleagues, Dutch orthopaedic surgeons recommended more liberal about the waiting-time. This could be related to the year of conducting. Interestingly, we found no relationship with the surgical approach (**Chapter 5**).

Waiting Time to Resume Sexual	Activity after THA				
Registered orthopaedic surgeons	Immediately when the patient feels ready	After 2-4 weeks	After 6-8 weeks	After 3 months	After 6 months
Netherlands Orthopaedic Association: Hip Working Group (n = 525); 2016	174 (33.1%)	28 (5.3%)	223 (42.4%)	95 (18.1%)	5 (1%)
British Hip Society United Kingdom (n = 79); 2011	16 (19%)	(4	39 7%)	21 (25%)	3 (4%)
American Association of Hip and Knee Surgeons USA (n = 251); 2004	10 (4%)	67 (27%)	10 (67	67 7%)	7 (3%)

Table 1: Surgeons'	Recommendations About the Appropriate Timing to Resume Sexual Activity
After THA [8, 62,	82]
For TKA, the recommendations were largely consistent, with 95% stating that there was no specific waiting period, although, it was acknowledged that resuming intercourse positions might be challenging for most patients. Additionally, almost all knee surgeons (n = 72; 95%) agreed that there were no restrictions for knee patients. However, half of them suggested that deep bending might cause structural inconvenience during certain positions, as recently also described by Kazarian et al. [4]. Nonetheless, a small percentage (n = 4; 5%) of surgeons expressed concerns about the potential risk of dislocation of the insert of the knee prosthesis, particularly with sexual positions requiring deep flexion of the knee (**Chapter 5**).

In 2014, Charbonnier et al. conducted a simulation motion capture study, involving two young, healthy volunteers using twelve intercourse positions as depicted by Dahm et al., under Magnetic Resonance Imaging (MRI) [76]. The study evaluated impingement and joint instability during simulations, based om MRI findings and identified positions at risk. One for men and four for women [76]. Following Charbonniers' advice, we queried a group of Dutch hip and knee surgeons regarding their opinion on potentially harmful sexual positions for patients after THA, taking into account the patient's gender. Of the hip surgeons surveyed, 25 (53.2%) of them stated that Charbonniers' advice could serve as a guideline, while 13 (28%) believed that every sexual position was safe. However, more recently (2023), a simulation study on potential hazards position for hip dislocation in different sexual positions was done in 12 patients who had received a robotic guided placed THA. Preoperative collected CT data (needed for the MAKO robotic surgery, including planned position of the THA) were used for simulation of collision or impingement of components using the 12 sexual positions of Charbonnier [77]. While Charbonnier's study identified one position for men (position 8) and four positions for women (position 3, 5, 8, and 10) at risk for hip dislocation [76], Stegelmann et al., found impingement (with potential risk for hip dislocation) in one position (position 5) for two female patients and in five positions (1, 5, 8, 10, and 11) for five male patients [77]. These findings underscore the wide variability in positions posing risks for hip dislocation (such as, anatomic pelvic-lumbar tilt, cup-head-stem position, soft-tissue tensioning), both in male and female individuals. Consequently, these studies also emphasise the need for further evidence-based research to substantiate current expert opinions and recommendations for patients in the postoperative period. Moreover, these findings also highlight the intricate relationship between intraoperative mechanical stability of a total hip system and potential postoperative hip dislocation, which is influenced by factors such as spine-pelvis interaction and differences in muscle

activation during multidirectional movement [83]. Alternatively, conducting new postoperative virtual simulation models, as was previously done for shoulder and hip patients, may offer further insights into hip-stem-head-cup positions posing a risk for dislocation [84, 85]. In summary, dislocation of the knee prothesis is a rare orthopaedic complication which attracts little attention in the literature, but often necessitates extensive revision surgery [86].

Implications for Clinical Practice

This thesis highlights the communication gap between patients and surgeons regarding issues of sexual activity related to THA and TKA procedures, but also the knowledge gap, between surgeons' views on safety related to sexual positions and the timing of resuming sexual activity, taking results from motion studies into account [76, 77].

Patients are often reluctant to initiate conversations about sex, but they do have questions [7, 9]. While sexual difficulties due to complaints of an arthritic hip was a factor in the decision to undergo THA for 20% of patients [9, 10] surgeons seem to be often unaware of the patients' overall quality of life related expectations of surgery, and more specific aspects related to sexual activity. Limited available literature suggests that patients expect orthopaedic surgeon to initiate discussions about sexual activity, given their familiarity with the patients' (local) conditions and implants [9, 10]. Our interviews with couples also revealed that they trusted the surgeon to provide safety guidelines.

As for the implication of daily clinical practice, some suggestions are:

- The discussion about sexual activity should be initiated by the medical professional in the consulting room [87]. Orthopaedic surgeons need an effective way to bridge the communication gap with reluctant patients (and partners) to discuss this topic.
- When addressing sexual activity, the PLISSIT (Permission Limited Information Specific Suggestions Intensive Therapy) model provides insight into the steps and professional responsibilities. Surgeons can use this model during consultations addressing sexual activity issues.
 - The first step is asking "Permission", for which we recommend a practical communication tool: a respectful "invitation sign" on the consultation desk indicating that questions about sexual activity are welcome, along with a reference to the website "Sick and Sex". Sexual activity should also be included in Frequently Asked Questions (FAQ) sections [88], on websites, and in patient information materials about THA and TKA, positioned as an essential part of the quality of life. Since there is no standard recommendation, additional tailored information from the patients' own surgeon is crucial [69].

- The second step is "Limited Information", as tailor-made advice and instructions are necessary on the timing and choice of sexual positions. The chart with the 12 common gender neutral sexual positions are useful (**Appendices**).
- "Specific Suggestions" should be given to patients with an increased risk of dislocation, considering the patient's individual situation, related to the permitted sexual intercourse positions [89].
- "Intensive Therapy" may involve a referral to an expert or the patients' general practitioner.
- Furthermore, addressing sexual activity requires attention in training during residency as well as for practising surgeons.
- Regarding the patients' preoperative expectations, sexual activity after THA and TKA go unmet in two out of five cases (**Chapter 3 and 4**). Managing expectations should lead to more realistic expectations and knowledge about what to expect, particularly regarding the bending limitations of the knee during intercourse [4].

An open communication during consultation of orthopaedic surgeon and patient is key to meet the patients' overall quality of life related expectations on a treatment in general and surgery in particular.

Future Perspectives

There is a lack of literature describing sexual activity of patients after THA, which is also related to the preoperative expectation of the patients [10, 63, 90–92]. Even more, regarding sexual activity in TKA patients, only one study (Kazarian et al.) addresses the impact of OA and surgery on sexual activity [4]. However, sexual activity is an important part of the quality of (senior) life [93–95] of many orthopaedic patients and partners. In general, men and women can remain sexually active into their 80s [60, 94, 96–98]. However, the sexual status of older patients is often misunderstood [98] and neglected by healthcare professionals because of the sensitivity to discuss this topic, both for patients and surgeons [8, 60, 99]. Consequently, addressing sexual activity issues in orthopaedic practice is far from a common attitude and many patients (and partners) will not feel encouraged to bring up questions on this topic [62, 100–102].

In this dissertation a very small group of couples was interviewed about sexual activity. Consequently, to provide insights into the prevalence within the population, further research will be needed. However, creating a more open and supportive communication environment in clinical practice could facilitate addressing sexual activity, which is essential for better understanding the challenges of couples before and after total hip and knee replacement surgery [88], which will support better future research as well. All the more, because orthopaedic surgeons are far from an agreement on a recommended postoperative waiting time when resuming safe sexual positions after THA, or TKA [62, 76, 77]. Recommendations on what is safe should be part of the postoperative routine instructions, preventing not only potential adverse events, like hip (and knee) dislocation, but also uneasiness of patients on which activities can be started and when. For that matter, the aim of this initial complex arthroplasty surgery was to create a value-added treatment to the patient [2].

The number of arthroplasties is increasing with patients undergoing surgery at both younger and older ages [74]. As a result, more THA and TKA patients will face preoperative sexual limitations due to hip and knee OA [4, 10, 55, 64], which has also influence on their expectation after such arthroplasty surgery. Consequently, preventing a mismatch between patients' preoperative expectation of sexual activity and the outcome after THA and TKA is important, to avoid a large group of unsatisfied patients, who are likely to create a financial burden to the healthcare system. Orthopaedic healthcare is more than just a focus on the musculoskeletal disease or injury as such, but also about added value to the patient and partner.

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General Summary

Introduction

Osteoarthritis (OA) is a prevalent chronic degenerative disease of the musculoskeletal system, characterized by pain, stiffness, and joint mobility limitation. In the Netherlands, approximately 1.5 million people experience OA to varying degrees, with more women than men affected. Treatment initially focuses on pain reduction and lifestyle adjustments, with surgery such as Total Knee Arthroplasty (TKA) or Total Hip Arthroplasty (THA) considered when conservative measures fail. Symptoms of OA can significantly impact daily activities, including sexual activity. Chronic pain and movement limitations due to OA can affect sexual activity and can cause tension in sexual relationship with the partner, mostly interfering for years until the decision for surgery is made.

This dissertation explores the perspectives of patients and partners regarding sexual activity before and after THA and TKA (Part I). Additionally, practices of orthopaedic surgeons are examined, including the timing and safe resumption of sexual activity after THA and TKA (Part II). The dissertation focused on the concept of "sexual activity" based on the functional aspect of intercourse rather than the broader domain of sexual quality of life.

Twelve common sexual positions known as the "twelve common sexual positions of Dahm" were used to further define sexual activity as functional mobility. We used the same sexual positions (as used in previous literature) as referring chart during the couple's interviews, and as an attachment next to the questionnaire which we have sent to THA and TKA orthopaedic surgeons (Chapter 5). The referring chart is included in the appendix of this dissertation.

Part I: Perceptions of Patients and Their Partners

A systematic review of literature on sexual activity in THA patients revealed a lack of research (**Chapter 2**). Articles on sexual topics in patients before or after THA/TKA were extensively searched (January 1970 to February 9, 2015). No literature was found for TKA. Shortly after the search deadline, the first quantitative retrospective article on sexual activity before and after TKA was published. Two years later, a retrospective article with more qualitative descriptions revealed that patients after TKA do experience many problems during sexual activity due to the diminished knee flexion (bending knee). The review included twelve studies, in total 2,099 patients aged 20–85 years. The methodological quality of ten studies was assessed as low, with only two of moderate quality.

The majority of patients experienced an improvement in "sexual quality of life" after surgery, both in terms of physical-functional and psycho-social well-being. However, the improvements varied widely: the change between preoperative and postoperative ranged extensively (sexual dysfunction before surgery Δ 8–51%, and resuming sexual activity after surgery Δ 0–77%).

We noted, the topic of sexual activity after THA and THA is under-researched. Investigating whether THA and TKA patients have expectations regarding sexual activity after surgery and whether those expectations are met, was justified.

Expectations of Sexual Activity in Patients

The Hospital for Special Surgery Expectation Survey (HSS) is a questionnaire used in many countries for this purpose. The questionnaire includes important items about expectations of daily life; the expectation of sexual activity is one of these. The HSS is longitudinally used as part of the Longitudinal Leiden Orthopaedics Outcomes of Osteoarthritis Study (LOAS) data and embedded in the LROI (Dutch Arthroplasty Register). There is a preoperative questionnaire asking patients about their postoperative expectation and a postoperative questionnaire asking about the "current status". By comparing these, the score and degree to which extent the expectation is fulfilled are determined.

Chapters 3 and 4 examined the expectations of sexual activity after surgery in THA and TKA patients. Two prospective multicentre cohort studies were conducted, analysing outcomes of 972 THA and 866 TKA patients. Both studies further examined associations, comparing the HSS with functional and health related questionnaires, longitudinally administered by LOAS as well.

For THA, 43.5% of patients did not meet the expectation of sexual activity after surgery, and for TKA patients, 42% did not. These outcomes were high compared to existing literature. The differences are likely explained by differences in sample sizes, year of search, and the large number of losses to follow-up, particularly concerning the question about the expectation of sexual activity. For this reason, we had decided to only use data from patients who had completed both the pre- and postoperative question. For both groups, associations with functional recovery and patient health related outcomes were found, which were generally lower in patients who did not meet their expectations. The results of both studies underscored the need for more in depth qualitative research. A semi-structured interview was a fluent next step.

Interviewing Patients' and Partners' Perceptions of Activity

Chapter 5, part I describes the themes emerged from the semi-structured interview. This qualitative research was conducted, one and a half year after surgery, with the patient and their partner, and with a senior orthopaedic surgeon as interviewer. Of the 150 invitations (sent by post, with an invitation letter including a clear explanation of the research purpose, and signed by their own practitioner), we received 90 responses. The majority (n = 85) returned the "non-participation" form. Only 5 couples were willing to participate in the interview. Reason for non-participation was mainly due to "not being sexually active" (47%), which was an exclusion criterion for the study, and the remaining 53% were sexually active, tough, 60% of all invited couples responded hesitating difficulties in discussing sexual issues. This indicated a significant taboo around this topic.

The small sample of the 5 couples who shared the conversation provided a homogeneous picture. Two themes were emerged: (i) couples adapted physically and mentally to new situations (both pre- and postoperatively) without considering safety of positions; (ii) couples fully trusted the surgeon as provider of information on safe resumption, if indicated. All couples were comfortable discussing sexual activity with their partner, in the presence of an orthopaedic surgeon. The small sample provided a clear picture, as a pilot study of a selective group. Generalization of the findings was not possible, which confirms the need for larger-scale research to better understand the prevalence and impact of sexual issues among the larger population of total hip and knee patients and their partners.

Part II: Perceptions of THA and TKA Surgeons

Discussing sexual activity in the consultation room is uncommon for orthopaedic surgeons; this holds true in most countries, including the Netherlands. In 2004, an initial study was conducted among American orthopaedic surgeons, where questions were asked regarding the safety of specific standard sexual positions and the timing for resuming sexual activity post-THA. In 2011, the question about safe resumption was revisited with orthopaedic surgeons in England. In 2016, we surveyed Dutch orthopaedic surgeons on this question — see Table 1.

In this comprehensive survey we further presented several themes to respondents (residents, orthopaedic surgeons, and senior/retired orthopaedic surgeons) in the Netherlands, about issues of sexual activity in THA patients (**Chapter 6**). The majority (78%) of the cohort reported (almost) never discussing sexual activity with patients during consultations (2016). The primary reason was that patients did not ask questions (47%), which meant that orthopaedic surgeons were unaware of potential patient inquiries (38.6%). This topic was also discussed less frequently with older patients over the age of sixty (25.9%). The "positive impact of a THA on sexual activity" was rated highest by older (retired) surgeons, with male surgeons scoring it higher than female surgeons. The importance of "sexual issues in the decision to undergo surgery" received the lowest ratings from residents. The "estimated risk of dislocation" varied between job roles and genders: female surgeons rated this concern highest (median score 5). More than half (54.1%) indicated that it is the orthopaedic surgeon's responsibility to provide information on safely resuming sexual activity. Opinions varied on the timing of resuming and were unrelated to the surgical approach.

Waiting time to resume sexual activity after THA								
Registered orthopaedic surgeons	Immediately when the patient feels ready	After 2–4 weeks	After 6–8 weeks	After 3 months	After 6 months			
Netherlands Orthopaedic Association: Hip Working Group (n = 525; Harmsen et al., 2016)	174 (33.1%)	28 (5.3%)	223 (42.4%)	95 (18.1%)	5 (1%)			
British Hip Society United Kingdom (n = 79; Wall et al., 2011)	16 (19%)	39 (47%)		21 (25%)	3 (4%)			
American Association of Hip and Knee Surgeons USA (n = 251; Dahm et al., 2004)	10 (4%)	67 (27%)	16 (67	167 (67%)				

Table 1: Surgeons' Recommendations About the Appropriate Timing to Resume Sexual Activity After THA

Safely Resuming Intercourse Hip and Knee Arthroplasty

In 2023 we published a mixed method study in which results from a semi-structured interview with couples are described and the surgeons' recommendations on safe resuming of sexual activity after THA and TKA (**Chapter 5**). The latter were all orthopaedic surgeons and members of the Dutch Orthopaedic Association (specifically the Hip and Knee working groups). We asked surgeons for their opinions on 12 sexual positions (previously used by Dahm et al.) and provided recommenda-

tions based on findings from Charbonnier et al., who identified (un)safe positions for men and women in THA patients (based on the same 12 sexual positions).

We found no consensus among THA surgeons, with opinions differing regardless the surgical approach (**Chapter 5**, Table 3). Consequently, no standardised information for patients or for Dutch orthopaedic practice was identified. For TKA patients, nearly all orthopaedic surgeons (95%) agreed that virtually all positions were permissible. However, they presumed that patients might not find all positions equally comfortable, as certain positions require extensive knee bending, which could be limiting in many cases. Five percent cited a possible risk of knee implant dislocation, a point not previously discussed in literature. The findings from this chapter underscores the need for further research and clear tailor-made information for patients since there is no communis opinion.

Implications for Clinical Practice

This dissertation highlights a communication gap between patients and surgeons regarding addressing sexual activity in THA and TKA patients. A second gap was found between the surgeons' expert opinions on safe sexual intercourse positions and the results in literature.

The study by Charbonnier et al. was agreed by 50% of orthopaedic THA surgeons as an objectively measured guideline (analysed by MRI imaging). However, a recent (2023) study showed contradictory results (analysed by CT imaging), using the same sexual positions. Therefore, a standard guideline for clinical practice is not investigated. However, the following findings are still important:

- The discussion about sexual activity should be opened in the consultation room. To start the communication, orthopaedic practices need an effective way to bridge this gap between "hesitant" patient and "unaware" surgeon.
- Regarding making sexual activity discussable, the steps of the PLISSIT model provide insight into the professional boundaries and responsibilities of the surgeon.
- Since not all patients are sexually active, patients should be encouraged to ask questions about sexual issues themselves.
- Making sexual activity discussable requires attention in the training of residents.
- Furthermore, in two out of five cases, preoperative patient expectations regarding sexual activity after THA and TKA were not met. Managing

expectations should lead to more realistic expectations and knowledge in patients, about what to realistically expect. It is important to know, that bending and kneeling postoperatively will interfere sexual intercourse.

- To achieve an open communication culture, a culture change in society will also have to be obtained; this will support the challenging task of the orthopaedic surgeon to address sexual issues during the consultation.

Future Perspectives

There is a lack of literature describing sexual activity of patients after THA and TKA, which is also related to the preoperative expectation of the patients. Sexual activity is an important part of the quality of (senior) life of many orthopaedic patients and partners. In general, men and women can remain sexually active into their 80s. However, the sexual status of older patients is often misunderstood and neglected by healthcare professionals because of the sensitivity to discuss this topic, both for patients and surgeons. Consequently, addressing sexual activity issues in orthopaedic practice is far from a common attitude and many patients (and partners) will not feel encouraged to bring up questions on this topic.

Creating a more open and supportive communication environment in clinical practice could facilitate addressing sexual activity, which is essential for better understanding the challenges of couples before and after total hip and knee replacement surgery, which will support better future research as well.

Orthopaedic surgeons are far from an agreement on a recommended postoperative waiting time when resuming safe sexual positions after THA, or TKA. Recommendations on what is safe should be part of the postoperative routine instructions, preventing not only potential adverse events, like hip (and knee) dislocation, but also uneasiness of patients on which activities can be started and when.

The number of arthroplasties is increasing with patients undergoing surgery at both younger and older ages. As a result, more THA and TKA patients will face preoperative sexual limitations due to hip and knee OA. Orthopaedic healthcare is more than just a focus on the musculoskeletal disease or injury as such, but also about added value to the patient and partner.

Part IV

Appendices





Nederlandse Samenvatting Communication Tool for Clinical Practice Dankbetuiging (Acknowledgements) Curriculum Vitae

Nederlandse Samenvatting

Inleiding

(Osteo)Artrose (OA) is een veel voorkomende chronische degeneratieve aandoening van het bewegingsapparaat, dat wordt gekenmerkt door pijn, stijfheid en een beperkte beweeglijkheid van de gewrichten. In Nederland hebben ongeveer 1,5 miljoen mensen in meer of mindere mate last van OA. De behandeling richt zich in eerste instantie op pijnvermindering en aanpassing van de levensstijl, waarbij in een later stadium (als conservatieve maatregelen falen) chirurgie zoals Totale Heup Artroplastiek (THA) of Totale Knie Artroplastiek (TKA) wordt overwogen. Symptomen van OA kunnen een aanzienlijke invloed hebben op de dagelijkse activiteiten, waaronder ook op seksuele activiteit en de kwaliteit van het (seks-) leven. Chronische pijn en bewegingsbeperkingen (als gevolg van OA) kunnen ook spanning veroorzaken in de (seksuele) relatie met de partner. OA bestaat meestal al jaren voordat de beslissing voor een operatie wordt genomen.

Dit proefschrift onderzocht de perspectieven van patiënten en hun partners (Part I) en de visies van orthopedisch chirurgen (Part II) met betrekking tot het thema seksuele activiteit voor en na THA en TKA. Het proefschrift geeft geen antwoord op het bredere domein van de seksuele kwaliteit van leven, maar gaat wel in op (veilige) hervatting van seksuele activiteit. De focus "seksuele activiteit" is afgebakend tot het functionele aspect bij twaalf veel voorkomende seksuele posities, die in de orthopedische literatuur bekend zijn als de "seksuele posities van Dahm". Deze posities zijn als referentiekader gebruikt tijdens de interviews met de paren en opgenomen in de vragenlijst die naar de orthopedisch chirurgen (werkgroep THA en TKA) werd verzonden. De referentiekaart met de seksuele posities is ter aanvulling opgenomen in de appendix van dit proefschrift en kan worden gebruikt om de communicatie in de spreekkamer te verduidelijken / ondersteunen.

Deel I: Perspectieven van patiënten en hun partners

Dit proefschrift is met een systematisch literatuuronderzoek gestart (**Hoofdstuk 2**) om inzicht te verkrijgen in wat er zoal over seksuele activiteit bij THA/TKA was gepubliceerd. Diverse zoekmachines zijn gebruikt om artikelen te vinden in een zeer lange zoekperiode (van januari 1970 tot 9 februari 2015). Desondanks is nauwelijks literatuur gevonden; voor de TKA-populatie werd geen enkel artikel gevonden. Kort na de zoektermijn werd het eerste kwantitatieve (retrospectieve) artikel over seksuele activiteit voor en na THA en TKA gepubliceerd (Nunley et

al.). Twee jaar later werd een tweede retrospectief artikel met meer kwalitatieve beschrijvingen gepubliceerd (Kazarian et al). Hierin werd voor het eerst beschreven dat patiënten na TKA ook problemen ervaren tijdens seksuele activiteit.

Om die reden is vanaf Hoofdstuk 4 besloten om de perspectieven voor de TKApopulatie in dit proefschrift mee te nemen.

De review in deze thesis (**Hoofdstuk 2**) includeert twaalf artikelen; in totaal 2.099 patiënten in de leeftijd van 20–85 jaar. De methodologische kwaliteit van de tien studies is door ons als laag beoordeeld; slechts twee konden worden gekwalificeerd als van matige kwaliteit. De meerderheid van de patiënten hadden een verbetering van de "kwaliteit van het seksleven" ervaren na de operatie, zowel in termen van fysiek-functioneel als psychosociaal welzijn. Echter de verbeteringen varieerden sterk: de verandering tussen de pre- en postoperatieve seksuele problemen van patiënten varieerde van Δ 8–51% minder problematiek. Voor de verbetering van seksuele activiteit na de operatie was de spreiding Δ 0–77%. De conclusie is dat het onderwerp seksuele activiteit voor en na THA onvoldoende is onderzocht. De logische vervolgstap voor dit proefschrift was om te onderzoeken of THA en TKA patiënten voor de operatie verwachtingen hebben van seksuele activiteit en of na de operatie aan die verwachtingen wordt voldaan.

Verwachtingen van seksuele activiteit

De Hospital for Special Surgery Expectation Survey (HSS) is een vragenlijst die in veel landen wordt gebruikt om patiënt-gerapporteerde verwachtingen te meten. De vragenlijsten bevatten ongeveer 17 items die gaan over de algemene verwachtingen van het dagelijks leven. De verwachting van seksuele activiteit is er daar één van. De HSS werd (tot 2018) longitudinaal gebruikt als onderdeel van de Longitudinal Leiden Orthopaedics Outcomes of Osteoarthritis Study (LOAS) en was ingebed in de LROI (Dutch Arthroplasty Register). De HSS bestaat uit een preoperatieve vragenlijst, waarin patiënten gevraagd worden om vóór de operatie hun verwachting aan te geven over hoe het na de operatie zal zijn en er is een postoperatieve vragenlijst waarin gevraagd wordt naar de "actuele status" van dat moment op dezelfde items. Door beide momenten met elkaar te vergelijken kan de score en de mate waarin aan de verwachting is voldaan, worden bepaald.

Er werden twee prospectieve multicenter cohortonderzoeken uitgevoerd (**Hoofdstuk 3 en 4**), waarbij uitkomsten van respectievelijk 972 THA en 866 TKA patiënten werden geanalyseerd. Voor THA voldeed bij 43,5% van de patiënten de

seksuele activiteit na de operatie niet aan de verwachting; voor de TKA-groep was dat 42%. Deze uitkomsten zijn hoog in vergelijking met resultaten uit bestaande literatuur. De verschillen zijn waarschijnlijk te verklaren door verschillen in steekproefgrootte, het zoekjaar en het grote aantal verlies aan antwoorden bij de vraag over de verwachting van seksuele activiteit. Wij hebben besloten om alleen gegevens te gebruiken van patiënten die zowel de pre- als postoperatieve vraag hadden ingevuld. Bij veel vergelijkbare bestaande artikelen waarin de HSS was gebruikt was dat niet het geval.

Twee van de vijf patiënten kwamen in onze studies niet op hun verwachting van seksuele activiteit uit. Zowel bij de THA- als TKA patiëntengroep zijn associaties gevonden op het gebied van functioneel herstel- en algemene gezondheid. Deze patiënt-gerapporteerde scores bleken lager bij patiënten die postoperatief niet op de preoperatieve verwachting van seksuele activiteit waren uitgekomen. De resultaten van beide artikelen onderstreepten de behoefte aan diepgaander kwalitatief onderzoek om meer inzicht te krijgen bij patiënten en hun partners op het thema seksuele activiteit na THA en TKA. Een semi-gestructureerd diepte-interview met seksuel actieve paren was dan ook een logische vervolgstap in dit proefschrift.

Perspectieven over seksuele activiteit (patiënten en hun partners)

Hoofdstuk 5, beschrijft de thema's die naar voren kwamen in het semi-gestructureerde interview. Dit kwalitatieve onderzoek werd anderhalf jaar na de operatie uitgevoerd met THA en TKA patiënten en hun partners, en met een senior orthopedisch chirurg als interviewer. Van de 150 uitnodigingen (per post verstuurd, met een uitnodigingsbrief met duidelijke uitleg over het onderzoeksdoel, ondertekend door de eigen behandelaar) ontvingen we 90 (60%) reacties. De meerderheid (n = 85) stuurde echter het formulier "niet deelnemen" terug. Slechts 5 paren waren bereid om deel te nemen aan het interview. De reden voor niet-deelname was voornamelijk het "niet seksueel actief zijn" (47%), wat een exclusiecriterium was voor het onderzoek. De overige 53% was weliswaar seksueel actief, echter 60% antwoordde het moeilijk te vinden om seksuele kwesties te bespreken.

Het interview met de slechts 5 overgebleven koppels die aan het interview deelnamen leverde wel een homogeen beeld op. Er kwamen twee duidelijke thema's naar voren: (i) koppels pasten zich fysiek en mentaal aan de nieuwe situaties aan (zowel pre- als postoperatief); (ii) koppels vertrouwden volledig op de chirurg als verstrekker van informatie over veilige hervatting na de operatie (als er sprake zou

zijn van risico). Ondanks het feit dat deze kleine steekproef een duidelijk beeld gaf moeten de uitkomsten gezien worden als een pilotstudie van een selectieve homogene groep. Alle paren voelden zich op hun gemak om seksuele activiteit met hun partner te bespreken en in aanwezigheid van een orthopedisch chirurg die hen "gevoelige" vragen stelde. Generalisatie van de bevindingen was niet mogelijk. Wanneer een beter inzicht in de prevalentie en impact van seksuele problemen bij de grotere populatie van totale heup- en kniepatiënten en hun partners gewenst is, zal een grootschaliger onderzoek noodzakelijk zijn.

Deel II: Perspectieven van THA- en TKA-chirurgen

Het bespreken van seksuele activiteit in de spreekkamer van orthopeden is niet gebruikelijk; niet in de meeste landen, ook niet in Nederland. In 2004 werd een eerste onderzoek uitgevoerd onder Amerikaanse orthopedisch chirurgen. Er werd o.a. gevraagd naar de veiligheid van bepaalde standaard seksuele posities en naar het tijdstip van hervatting van seksuele activiteit (na THA). In 2011 is de vraag over veilige hervatting herhaald bij orthopedisch chirurgen in Engeland. In 2016 hebben wij de Nederlandse orthopedisch chirurgen bevraagd over deze vraag, zie Tabel 1.

Wachttijd voordat seksuele activiteit na THA kan worden hervat								
Geregistreerde orthopedisch chirurg	Als de patiënt eraan toe is, meteen	Na 2-4 weken	Na 6–8 weken	Na 3 maanden	Na 6 maanden			
Nederlandse Orthopedische Vereniging: Heup Werkgroep (n = 525; Harmsen et al., 2016)	174 (33.1%)	28 (5.3%)	28 223 (5.3%) (42.4%)		5 (1%)			
British Hip Society United Kingdom (n = 79; Wall et al., 2011)	16 (19%)	(4	9 21 7%) (25%)		3 (4%)			
American Association of Hip and Knee Surgeons USA (n = 251; Dahm et al., 2004)	10 (4%)	67 (27%)	1 (62	67 7%)	7 (3%)			

Tabel 1	: Aanbevelingen	van chi	rurgen o	over de	juiste	timing	voor	het	hervatten	van	seksuele
activite	it na THA										

In een uitvoerige survey (**Hoofdstuk 6**) hebben wij de respondenten (artsassistenten, orthopeden en senior/gepensioneerde orthopeden) meerdere thema's voorgelegd. De meerderheid (78%) van de orthopedisch chirurgen in Nederland besprak (bijna) nooit het thema seksuele activiteit met patiënten in de spreekkamer (2016). De belangrijkste reden was dat patiënten geen vragen stellen (47%). Daardoor waren de orthopeden zich niet bewust van potentiële vragen bij patiënten (38,6%). Het onderwerp werd ook minder vaak besproken met oudere patiënten boven de zestig (25,9%).

Het "gunstige effect van een THA op de seksuele activiteit" werd het hoogst beoordeeld door oudere (gepensioneerde) chirurgen, waarbij mannelijke chirurgen hoger scoorden dan vrouwelijke. Het belang van "seksuele problemen in de beslissing om een operatie te ondergaan" werd het laagst beoordeeld door arts-assistenten. Het "geschatte risico op luxatie" varieerde tussen de functies en het geslacht van de chirurg: vrouwelijke chirurgen beoordeelden deze vraag het hoogst (mediaan 5). Meer dan de helft (54,1%) gaf aan dat de orthopedisch chirurg verantwoordelijk is voor het geven van informatie over veilig hervatten van seksuele activiteit. Over de timing van het moment van hervatten liepen de meningen uiteen. De resultaten van dit hoofdstuk benadrukten het belang van duidelijke informatie voor patiënten.

Hervatten van seksuele activiteit

Hoofdstuk 5 bevat naast de resultaten van het semi-gestructureerde interview met de paren, ook een paragraaf met aanbevelingen van orthopedisch chirurgen over veilige hervatting van seksuele activiteit na THA en TKA. De respondenten waren allen lid van de Nederlandse Orthopedische Vereniging (respectievelijk van de werkgroep Heup en de werkgroep Knie). We vroegen de chirurgen hun mening te geven over de 12 seksuele posities (eerder gebruikt door Dahm et al.) en we gaven een advies mee gebaseerd op de uitkomsten in de studie van Charbonnier et al., waarin (on)veilige posities voor mannen en vrouwen werden genoemd. De meningen liepen ook uiteen ongeacht de chirurgische aanpak (zie Tabel 3, **Hoofdstuk 5**. Het ontwikkelen van standaard informatie voor de patiënt en voor de Nederlandse orthopedische praktijk was derhalve niet te beschrijven.

Voor de TKA-patiënt waren bijna alle orthopedisch chirurgen (95%) het erover eens dat in principe alle posities toegestaan waren. De chirurgen veronderstelden wel dat de patiënten niet alle posities als even comfortabel zouden ervaren, omdat voor sommige posities de knie te veel gebogen moet worden. Vijf procent benoemde een mogelijk risico op dislocatie van het knie-implantaat. Dit is niet eerder beschreven en benadrukt de noodzaak van meer onderzoek.

Implicaties voor de klinische praktijk

Dit proefschrift legt een communicatiekloof bloot tussen patiënten en chirurgen met betrekking tot het bespreekbaar maken van seksuele activiteit na THA en/of TKA. Ook werd een grote spreiding gevonden tussen de chirurgen onderling, over wat veilige seksuele posities zijn en in vergelijk met resultaten uit de literatuur. De adviezen van de studie van Charbonnier et al. (waarin bewegingen bij seksuele posities geanalyseerd werden met MRI-beeldvorming en twee vrijwilligers), zijn door 50% van de orthopedische chirurgen overgenomen als een voor de praktijk te gebruiken objectief gemeten richtlijn voor THA.

In 2023, nadat onze studie (Hoofdstuk 5) was afgerond, kwam nieuwe literatuur beschikbaar die de veiligheid van seksuele posities per gender analyseerde, preoperatief, met behulp van CT-beeldvorming en robot chirurgie en bij 12 'echte' patiënten. Deze resultaten bleken op essentiële onderdelen tegenstrijdig aan de resultaten van Charbonnier et al.

De volgende aanbevelingen voor de klinische praktijk zijn te geven:

- De discussie over seksuele activiteit moet worden geopend in de spreekkamer.
- Om de communicatie op gang te brengen, hebben orthopedische praktijken een praktische manier nodig om de kloof tussen de "aarzelende" patiënt en de "onwetende" chirurg te overbruggen. Het is immers niet bekend of er een vraag speelt bij de patiënt en of de patiënt het onderwerp misschien niet bespreekbaar durft te maken.
- Om seksuele activiteit bespreekbaar te maken, geven de stappen van het PLISSIT-model een goed theoretisch inzicht in de professionele grenzen en verantwoordelijkheden van de chirurg en de fasen van het bespreekbaar maken.
- Aangezien niet alle patiënten seksueel actief zijn, moeten patiënten vooral ook zelf worden aangemoedigd om vragen te stellen over seksuele kwesties die er bij hen spelen.
- Het bespreekbaar maken van het thema seksuele activiteit vereist wellicht meer aandacht in de opleiding van arts-assistenten.
- Twee van de vijf patiënten kwamen niet uit op de preoperatieve verwachting van seksuele activiteit na THA en TKA, ook al weten we daar de betekenis niet van. Verwachtingenmanagement kan wel leiden tot meer realistische verwachtingen en kennis bij patiënten. Zo is het belangrijk om te weten dat het buigen en knielen met een knieprothese, de hervatting van geslachtsgemeenschap in de weg zouden kunnen staan.

 Om een open communicatiecultuur in de spreekkamer te kunnen bereiken zal er maatschappelijk ook iets moeten worden veranderd: de taboesfeer rond seksuele activiteit (en specifiek in relatie tot ouderen) zou doorbroken moeten worden. Dat zal de uitdagende taak – waar de orthopedisch chirurg voor staat – ondersteunen en wellicht zullen seksuele kwesties dan "gewoon" worden aangekaart in de spreekkamer; ook door de patiënt zelf.

Perspectieven voor de toekomst

Seksueel actief blijven is een belangrijk onderdeel van de kwaliteit van leven; ook van veel orthopedische patiënten en hun partners. Over het algemeen kunnen mannen en vrouwen seksueel actief blijven tot op hoge leeftijd. De seksuele status van oudere patiënten wordt echter vaak verkeerd begrepen of "verwaarloosd" vanwege de gevoeligheid die er bestaat om dit onderwerp te agenderen. Deze communicatiekloof geldt zowel voor patiënten als voor de chirurgen. Gevolg is dat het bespreekbaar maken van problemen rond seksuele activiteit in de orthopedische praktijk verre van standaard is. Veel patiënten (en partners) voelen zich daarom niet aangemoedigd om vragen over dit onderwerp te stellen. Het creëren van een meer open, ondersteunende communicatieomgeving in de spreekkamer zal een meerwaarde opleveren voor het beter begrijpen van de prevalentie van seksuele problemen bij OA en de uitdagingen waarvoor paren staan, voor en na een heup- of knie vervangende operatie.

Dit proefschrift gaf geen inzicht in het effect van het niet uitkomen van de preoperatieve verwachting van seksuele activiteit. Orthopedische chirurgen zijn het in dit proefschrift niet eens over de aanbevolen postoperatieve wachttijd voor veilige hervatting van seksuele posities na THA. Tot op heden zijn slechts twee (objectieve) studies gedaan met betrekking tot het meten van de risico's bij hervatting van seksuele activiteit. Aanbevelingen over welke posities veilig zijn, zouden deel moeten uitmaken van de dagelijkse postoperatieve routine-instructies, niet alleen om mogelijke ongewenste voorvallen, zoals een luxatie van heup (en knie) te voorkomen, maar ook om de onzekerheid bij patiënten weg te nemen over welke activiteiten wanneer precies gestart kunnen worden.

Het aantal heup- en knievervangingen neemt toe, waarbij patiënten zowel op jongere als op oudere leeftijd worden geopereerd. Als gevolg hiervan zullen meer THA en TKA patiënten preoperatief te maken krijgen met seksuele beperkingen door heup- en knie OA en zullen vragen hierover groeien; ook over veilige seks met een prothese. Orthopedische gezondheidszorg is meer dan alleen een focus op de musculoskeletale ziekte of verwonding. Als zodanig hoort de orthopedische zorg ook toegevoegde waarde te bieden op het sensitieve onderwerp van seksualiteit wanneer dit voor de (individuele) patiënt en zijn of haar partner belangrijk is.

Communication Tool for Clinical Practice

Chart with 12 standard sexual intercourse positions: to discuss resuming sexual activity

The chart below proved to be a useful tool during the interviews (Chapter 5) to address the topic of sexuality without embarrassment. In a neutral way, (tailor-made) explanations can be noted by the surgeon to discuss risks of dislocation with patients and their partners. Also useful to hang up in the consulting room; patients may then dare to come up with their questions more easily.



9

Communicatiehulpmiddel voor de klinische praktijk

Kaart met 12 standaard seksuele posities om de hervatting van seksuele activiteit te bespreken

Onderstaande kaart bleek een handig hulpmiddel tijdens de interviews (Chapter 5) om zonder gene het onderwerp seksualiteit aan te snijden. Op een neutrale wijze kan door de chirurge (tailormade) uitleg worden gegeven, om risico's voor dislocatie te bespreken met patiënten en hun partners. Ook handig om in de spreekkamer op te hangen; patiënten durven dan mogelijk eerder met hun vragen te komen.


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VUMC

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LUMC

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Onmisbare wetenschappelijke contacten

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Het Promotieteam

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Alleen degenen die het aandurven om groots te falen krijgen de kans om groots te slagen – Robert. E. Kennedy

Curriculum Vitae

Rita Harmsen was born on August 2, 1953, in Braamt, Municipality of Bergh, The Netherlands, as a daughter of a building contractor (father) and nursing expert (mother).

After completing high school, she immediately enrolled in nursing school, where she passed with good results. She subsequently completed Cardiac Care Training and the Teacher Training for nurses. She worked as a nursing teacher in Doetinchem, at the Academic Hospital in Leiden, and at the School of Nurses at VU in Amsterdam.



After meeting her husband Pieter, an orthopaedic surgeon, she briefly switched career to business, selling hip and knee prostheses in 1982. However, this did not turn out to be her preferred direction, and the same year, she returned to hospital work (OLVG Amsterdam), where she served as head nurse and coordinating head nurse. In 1990 she became Vice President of Nursing at Medical Center Alkmaar, during which time she started a Postdoctoral Education in Hospital Policy Studies (completed in 1992). Subsequently, she followed the University study Master of Health Care Management at the TIAS Institute in Tilburg (completion 1994). Immediately afterwards graduation, she became vice president of Clinical Care in Zaans Medical Center (1994–1998).

In 2000, as a result of a reorganization, she made a new career switch and started an interim consulting intervention practice and focussed on projects of redesigning Patient Care in medical offices in hospitals and continued studying. Respectively, a Colloquium doctum (mathematics and statistics), and the University study of General Social Sciences Management and Communication at the University of Utrecht (finished in 2000).

Finally, she has studied and experienced professional change management since the turn of the millennium, mainly in hospitals. Successively, she worked for 12 years, mainly in top clinical hospitals (e.g. OLVG Amsterdam and North-West Hospital Group) on large CEO-driven 'transformations' that challenged her career. Since then, based on her roots, redesigning 'patient-centred performance' was Rita's focus throughout her life and career, always in collaboration with medical specialists

and the enabling organisation. She believed in crushing and simplifying work processes. She did not hesitate to suggest opportunities for improvement, always from the perspective of patients. For most patients, the surgeon (followed by teams of nurses) is the most important person during the consultation regarding their illness. It was her great challenge to enhance processes and make communication frank and open. Completing her career with the subject of her PhD, then, was not a surprise though a gradual consequence.

In 2013, she took a PhD preparation course at HOVO Amsterdam. In 2015, she wrote her first scientific article, which was published in 2016. Rita completed her dissertation at the age of 71 in the summer of 2024.

Rita has been married to Pieter for over 40 years and has a son Roderik, and a daughter-in-law, Wendy. Recently, they became parents to the "most beautiful baby in the world", named Clint, born on April 29, 2024. Rita also shares the joy of having two stepchildren from Pieter's previous marriage: Joris and Dorien. Both have two children of their own: the adorable and promising Maya and the intelligent whizz-kid Daniël, as well as the very handsome teenage twins, Sam and Meg.

