Original Research

Predictors of Return to Work After High Tibial Osteotomy

The Importance of Being a Breadwinner

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Background: Limited evidence exists on patient-relevant outcomes after high tibial osteotomy (HTO), including return to work (RTW). Furthermore, prognostic factors for RTW have never been described.

Purpose: To investigate the extent and timing of RTW in the largest HTO cohort investigated for RTW to date and to identify prognostic factors for RTW after HTO.

Study Design: Cohort study; Level of evidence, 3.

Methods: Consecutive patients who underwent HTO between 2012 and 2015 were included. Patients received a questionnaire at a mean follow-up of 3.6 years. Questions were asked pre- and postoperatively regarding work status, job title, working hours, preoperative sick leave, employment status, and whether patients were their family's breadwinner. The validated Work Rehabilitation Questionnaire (WORQ) was used to assess difficulty with knee-demanding activities. Prognostic factors for RTW were analyzed using a logistic regression model. Covariates were selected based on univariate analysis and a directed acyclic graph.

Results: We identified 402 consecutive patients who underwent HTO, of whom 349 were included. Preoperatively, 299 patients worked, of whom 284 (95%) achieved RTW and 255 (90%) returned within 6 months. Patients reported significant postoperative improvements in performing knee-demanding activities. Being the family's breadwinner was the strongest predictor of RTW (odds ratio [OR], 2.92; 95% confidence interval [CI], 1.27-6.69). In contrast, preoperative sick leave was associated with lower odds of RTW (OR, 0.20; 95% CI, 0.08-0.46).

Conclusion: After HTO, 95% of patients were able to RTW, of whom 9 of 10 returned within 6 months. Breadwinners were more likely to RTW, and patients with preoperative sick leave were less likely to RTW within 6 months. These findings may be used to improve preoperative counseling and expectation management and thereby enhance work-related outcomes after HTO.

Keywords: knee osteoarthritis; high tibial osteotomy; return to work; prognostic factor; directed acyclic graph; employment

Because of an aging society, the obesity epidemic, and the increasing retirement age in many countries, the number of patients of working age who suffer from debilitating knee osteoarthritis (OA) is steadily increasing.[23,24,46,47] Given the associated pain, functional limitations, and subsequent absenteeism from work,[6] adequate treatment is clearly required, both from personal and societal perspectives.[16,34,48] While knee arthroplasty (KA) has long been considered the best surgical treatment option,[6,33] reports of markedly increased revision rates in young, active patients have tempered enthusiasm for KA.[9,35] Given the worldwide increasing incidence of knee OA in working-age patients,[22] who almost always wish to return to work (RTW) after surgery,[12,46,50] clinicians search for treatment alternatives to KA in this demanding population.

As a result, high tibial osteotomy (HTO) has received renewed attention as a treatment alternative to KA, especially in younger, active patients with knee OA.[3,39] A study showed that up to 50% of patients with knee OA indicated for surgery have jobs that include knee-demanding activities, such as kneeling, lifting, and walking stairs.[46] In HTO, native knee structures are spared, which results in improved range of motion compared with unicompartmental KA and improved knee kinematics, which were comparable with healthy controls.[5,43] In theory, this improvement would lead to higher rates of RTW and less difficulty in performing

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knee-demanding activities. This was supported by a meta-analysis revealing that 85% of patients could RTW after HTO,[15] while RTW after KA varied between 56% and 89%, with a pooled estimate of 70%.[19] Furthermore, patients who have undergone KA often experienced marked difficulty with knee-demanding activities postoperatively,[19] although comparative data for patients undergoing HTO are lacking.

Thus, HTO has shown promising results regarding RTW, specifically when compared with KA. However, time to RTW and the ability to perform knee-demanding activities have been poorly studied.[12,15] Also, no study has investigated prognostic factors for RTW after HTO. Realistic preoperative expectations are known to play an essential role in obtaining postoperative satisfaction in patients with knee OA.[12,29] Furthermore, patients with knee OA of working age undergoing KA expressed a strong desire for more patient-tailored RTW advice.[1] Therefore, establishing factors that influence patient-relevant outcomes, including RTW, may facilitate more patient-tailored preoperative expectation management and could thus be of great importance to both patients and orthopaedic surgeons.

Therefore, the primary aim of this study was to investigate the extent and timing of RTW after HTO in the largest cohort to date regarding work-related outcomes. The secondary aim was to identify prognostic factors for successful RTW. We hypothesized that HTO would allow for a high RTW rate and fast RTW, given the advantages of retaining native knee structures.

METHODS

Study Design and Patient Selection

We performed a monocenter cross-sectional study in consecutive patients who underwent HTO between 2012 and 2015. HTO procedures were identified based on the surgical code (038604) in the database of electronic patient records (HiX; ChipSoft). We previously reported that our clinic uses the HTO selection criteria as formulated by the International Society of Arthroscopy, Knee Surgery, and Orthopaedic Sports Medicine, stating that the ideal patient undergoing HTO is aged 40 to 60 years with a body mass index (BMI) <30 kg/m^2.[3] Eligibility criteria for the present study included age between 18 and 70 years at follow-up, good understanding of the Dutch language, and sufficient ability to complete the questionnaire. Patients who had been treated with HTO bilaterally were asked to complete the questionnaire for the most recent operative procedure. An online questionnaire was developed using an electronic data management system (Castor EDC; www.castoredc.com). Eligible patients received an invitation by email between May and July 2017, followed by a maximum of 2 telephone reminders. Because the aim of the study was to investigate RTW in the largest possible cohort, a sample of convenience was used. However, based on a previous study on prognostic factors for RTW in patients undergoing KA, a minimum sample size of 120 patients was considered necessary to detect relevant differences in RTW.[40] The study was performed in accordance with the ethical standards of the Declaration of Helsinki of 1975, as revised in 2000. Institutional review board approval was obtained from the local medical ethical review board. All patients provided written informed consent.

Patient Characteristics

Patients' age, BMI, and education level were collected. Also, patients were asked if they had experienced postoperative complications and whether they had undergone surgery on the same leg again after HTO (eg, revision surgery or KA). The American Society of Anesthesiologists classification, degree of correction, and additional information on possible revision surgery and hardware removal were collected from the electronic medical record.

Surgical Technique and Rehabilitation

Surgery was performed by 1 of 3 dedicated knee osteotomy surgeons. The frontal- and transverse-plane HTO techniques have been described in previous publications.[3,45] For varus malalignment, patients underwent biplanar medial opening wedge HTO. For valgus malalignment, patients underwent biplanar medial closing wedge HTO. Patients with rotational malalignment of the tibia were treated with biplanar transverse derotation HTO. In case of a sagittal-plane deformity, patients were treated with single-plane flexion or extension HTO[11] (Figure 1). Before surgery, detailed planning was performed for each patient. Degrees of correction in the frontal and sagittal planes were converted to millimeters of wedge to be created or resected, as measured on the calibrated radiographs. In the operating room, calipers and rulers were used to define the wedge in the bone with K-wires under fluoroscopic guidance.

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Ethical approval for this study was obtained from the Academic Medical Center, University of Amsterdam (No. W17 382 17.448).

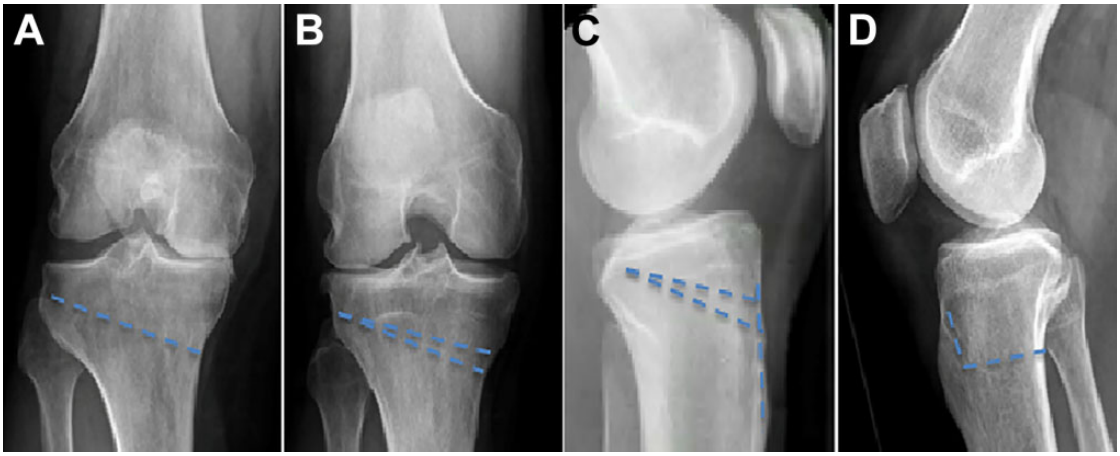

Figure 1. Preoperative anteroposterior/lateral radiographs of high tibial osteotomy (HTO) with projected osteotomy cuts (striped lines). (A) Right knee before opening wedge HTO, (B) right knee before medial closing wedge HTO, (C) left knee before anterior closing wedge HTO, and (D) right knee before derotation osteotomy.

Transverse-plane corrections were calculated from standardized computed tomography scans. Intraoperatively, a tracker specifically designed for rotational measurements was used, together with K-wires, defining the angle of rotation in the bone. Plate fixation for all opening wedge, closing wedge, and derotation HTO procedures was performed with angular stable plates (TomoFix; Synthes). For single-plane flexion or extension HTO, fixation with 2 staples (Stryker) and 3 small fragment screws (Synthes) was performed. Postoperatively, physical therapy–guided immediate range of motion exercises and muscle strengthening were initiated. All patients were restricted to partial weightbearing for 6 weeks. No postoperative bracing was used. Thromboembolic prophylaxis (ie, enoxaparin 40 mg) was prescribed once daily for 6 weeks. After 6 weeks, knee radiographs were obtained to verify bone healing and stability of fixation. Full weightbearing was allowed thereafter, provided that bone healing and stability of fixation were sufficient. At 3 months postoperatively, knee radiographs and, if deemed necessary, full-length standing radiographs were obtained to verify bone healing and the correction of deformities, respectively. Plate removal was performed only in patients with persistent functional limitations, which were likely caused by the plate.

Work Outcome Measures

Because no validated RTW questionnaire exists, we developed a questionnaire based on previous studies in knee osteotomy and KA.[10,14,36,40] The primary outcome measure was the percentage of patients who returned to work postoperatively and the timing of RTW. Patients were asked whether they worked before the onset of restricting knee symptoms and in the 3 months prior to surgery. Job title was recorded and classified as low, intermediate, or high knee-demanding work by 2 occupational experts, who independently scored all jobs based on work-related physical demands on the knee.[21,47] Also, patients reported preoperative sick leave for any reason in the month before surgery, and their intention to RTW was asked as well as their employment status and whether they were their family's breadwinner (ie, providing $>50\%$ of the family's income). Next, information on working hours, changes in workload, and, if patients did not RTW postoperatively, reasons for not returning to work were obtained. Finally, the validated Work Rehabilitation Questionnaire (WORQ) was used to assess the effect of HTO on work-related activities.[18] The WORQ consists of questions on 13 knee-demanding activities such as kneeling, lifting/carrying, and climbing stairs. Patients graded the difficulty that they experience when performing each activity on a 5-point Likert scale, with 0 meaning "no difficulty at all" and 4 meaning "extreme difficulty/unable to perform." Patients were asked to retrospectively grade the difficulty at 3 time points: 3 months preoperatively, 1 year postoperatively, and at final follow-up.

Statistical Analysis

Demographic data, preoperative and postoperative work status, and timing of RTW were analyzed using descriptive statistics. Primary analyses were performed for the total cohort. Next, because the predominant indication for surgery was OA, subgroup analyses on RTW were performed for the OA and non-OA groups. To investigate prognostic factors for RTW, a logistic regression model was used. Because of the expected low percentage of no RTW,[15] RTW was divided into 2 categories for regression analysis: RTW within 6 months (RTW $\leq$6 months) and RTW after more than 6 months, including no RTW at all (no RTW $\leq$6 months).[13] Univariate analysis was performed to assess baseline differences between patients who did RTW $\leq$6 months compared with patients who did not RTW $\leq$6 months. Variable selection was based on a causal path diagram that was created using the directed acyclic graph (DAG) approach.[38] Covariates were selected based on recent literature on HTO,[15,28] known prognostic factors for functional outcomes in KA,[7,31,42,49] and hypothesized relationships. With the DAG approach, an a priori

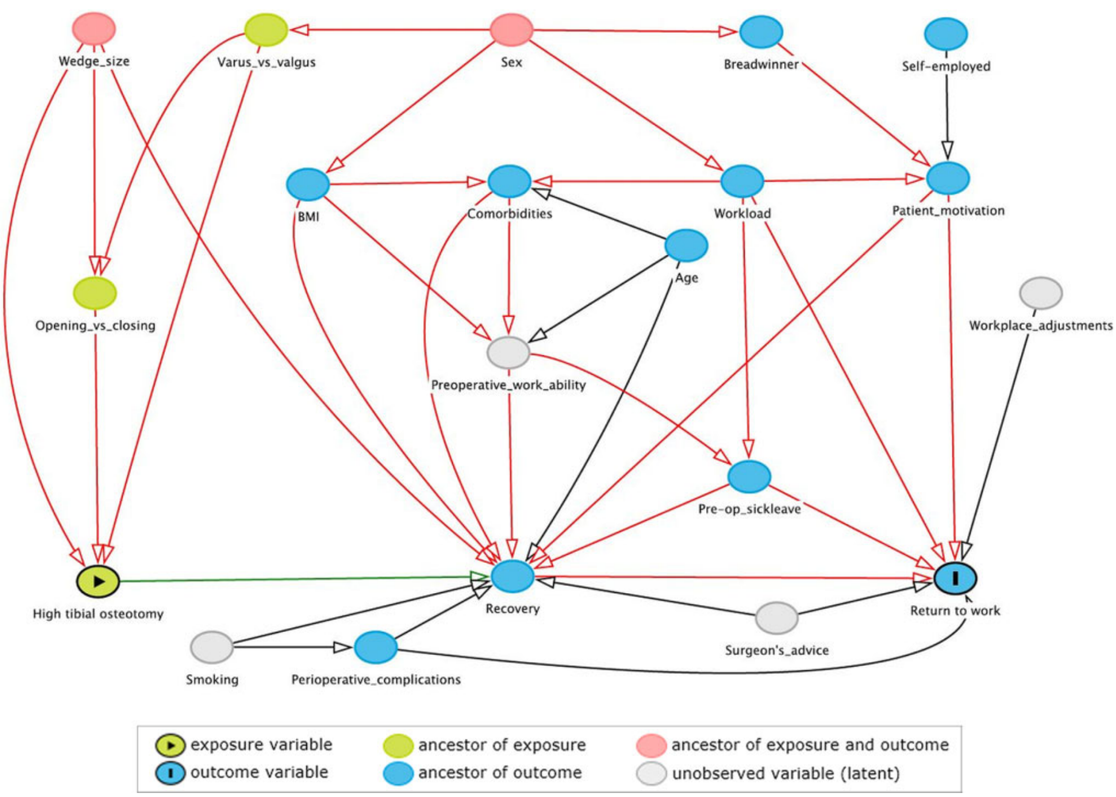

Figure 2. Directed acyclic graph describing the causal assumptions used for the selection of covariates.

model of the postulated relationships between the exposure (HTO), outcome variable of interest (RTW), and covariates was established.[38] This led to theoretical- and expert-based adjustments and the most parsimonious model being chosen, without the risk of overadjustment and associated reduction of statistical power. In the DAG (Figure 2), arrows represent direct causal effects of one factor on another. For example, being self-employed is hypothesized to increase patients' motivation, thereby positively influencing RTW. Based on the assumptions described in the diagram, the adjustment set required to estimate the effect of covariates on RTW after HTO included the following variables: BMI, degree of correction, breadwinner (yes/no), preoperative sick leave (yes/no), and preoperative workload. By adjusting for these factors, the effect of all the described covariates in Figure 2 on RTW was investigated. The DAG was created using DAGitty (Version 2.3).[41] A P value $<.05$ was considered significant. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. All statistical analyses were performed with SPSS for Windows (Version 24.0; IBM).

RESULTS

Participants

Of 482 identified consecutive HTO procedures in the electronic patient database, 402 were eligible for participation (Figure 3). A total of 402 patients responded at a mean follow-up of 3.6 ± 1.0 years, and 363 patients completed the questionnaire. For the final RTW analysis, 349 patients were included. Table 1 presents the baseline characteristics for the total cohort and for the OA and non-OA subgroups.

Return to Work

Of 349 patients, 315 worked presymptomatically, and 299 patients still worked 3 months preoperatively. Of these 299 patients, 76% were employees, 20% were self-employed, and 4% were both employed and self-employed. The preoperative knee-demanding workload was light in 51%, medium in 33%, and heavy in 16% of patients. Preoperative sick leave was reported by 44 patients (15%). Additionally, 290 patients (98%) declared that they intended to RTW. Postoperatively, 284 patients (95%) returned to work, of whom 255 patients (90%) returned within 6 months (Figure 4). Regarding reasons for no RTW, 8 patients reported complaints related to the operated knee, 6 patients reported physical complaints unrelated to the operated knee, and 1 patient had lost his job. Postoperative knee-demanding workload was lower in 12% of patients, the same in 80%, and higher in 8%.

Patient-Reported Changes in Work-Related Capacity

WORQ scores at 3 time points revealed that preoperatively, patients experienced the most difficulty with crouching, kneeling, clambering, taking the stairs, and walking on rough terrain (Figure 5). Postoperatively, an improvement

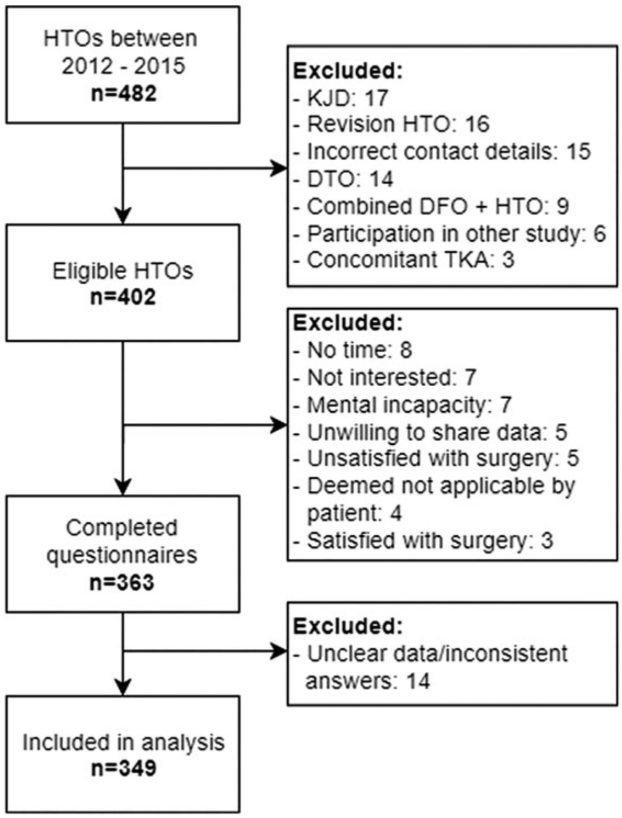

Figure 3. Inclusion flow diagram. DFO, distal femoral osteotomy; DTO, distal tibial osteotomy; HTO, high tibial osteotomy; KJD, knee joint distraction; TKA, total knee arthroplasty.

was observed for all activities. The largest improvement was reported for crouching and taking the stairs (32% and 30%, respectively), with fewer patients reporting extreme difficulty or being unable to perform these knee-demanding activities (Figure 5).

OA Versus Non-OA Group

In the OA group, 241 of 254 patients (95%) returned to work, which was comparable with 43 of 45 patients (96%) in the non-OA group ($P = .77$). In the OA group, 47% returned to work within 2 months compared with 38% in the non-OA group. The proportion of patients who returned to work within 6 months did not differ between the OA and non-OA groups ($P = .16$). Also, the postoperative changes in workload did not differ between groups ($P = .17$). For the OA group, the working hours were equal preoperatively, 1 year postoperatively, and at final follow-up. For the non-OA group, the number of working hours at follow-up increased compared with preoperatively ($P < .001$). Details on preoperative and postoperative working hours can be found in Appendix Table A1.

Prognostic Factors for RTW

Univariate analysis showed 8 variables that significantly differed between the RTW and no RTW groups (Table 2). The multivariable logistic regression model included BMI, wedge size (<10 or ≥10 mm), breadwinner (yes/no), preoperative sick leave (yes/no), and preoperative workload (low/intermediate/high). The model was statistically significant ($P < .05$), explained 24% (Nagelkerke R^2) of the variance in RTW, and correctly classified 88% of cases. Patients who reported being their family's breadwinner were more likely to RTW within 6 months (OR, 2.92; 95% CI, 1.27-6.69) (Table 3). In contrast, preoperative sick leave significantly lowered the odds of returning to work within 6 months (OR, 0.20; 95% CI, 0.08-0.46). Patients with an intermediate workload were less likely to RTW (OR, 0.40; 95% CI, 0.17-0.97), while no association was found between high workloads and RTW within 6 months. Last, BMI and wedge size were not significantly associated with RTW.

DISCUSSION

The present study, describing the largest HTO cohort studied for RTW to date, showed that 95% of patients returned to work after HTO, of whom 90% returned within 6 months. We found no differences in RTW or time to RTW between patients with knee OA and patients with other indications for HTO. Compared with the preoperative situation, the postoperative workload was equal or higher in 88% of patients. A large number of patients reported a significant decrease in experiencing difficulty in performing knee-demanding activities, such as kneeling and taking the stairs. Last, being the family's breadwinner was associated with a 2.9 times greater chance of RTW within 6 months. In contrast, preoperative sick leave resulted in a 5.0 times lower chance of RTW within 6 months.

Recently, Grünwald et al[12] showed that patients undergoing HTO considered return to employment to be the most important expectation of their surgery. Also, almost all patients expected to RTW at their presymptomatic work ability level.[12] In that context, our RTW percentage of 95% seems very promising. It is noticeably higher than the average reported percentage of 85% in a meta-analysis on patients undergoing HTO,[15] although the 2 largest included studies were in soldiers and farmers (ie, patients with high workloads). Also, our RTW percentage is markedly higher than the pooled RTW estimate of 70% after KA, although the reported KA population was older (mean age, 66 years) and slightly heavier (mean BMI, 29.4 kg/m^2).[19] Several explanations for our high RTW rate may exist, which include surgery- and patient-related factors.

Regarding surgery-related factors, it is known that high surgeon volume positively influences outcomes after surgical procedures, including KA.[26] Additionally, Liddle et al[27] found that in unicompartmental KA, the proportion rather than the total number of performed KA procedures influenced outcomes. Surgeons who performed unicompartmental KA in 40% to 60% of their total KA practice obtained significantly better results compared with surgeons who performed unicompartmental KA in <20% of patients.[27] Thus, underusage of unicompartmental KA in eligible patients with knee OA resulted in worse results, and one could hypothesize that the same accounts for HTO. While

TABLE 1
Baseline Characteristics[a]

	Total (N = 349)	OA Group (n = 288)	Non-OA Group (n = 61)
Age at surgery, y	47.1 ± 12.1	50.3 ± 9.2	32.0 ± 12.4
Follow-up, y	3.6 ± 1.0	3.7 ± 1.0	3.4 ± 1.0
Female sex, n (%)	157 (45)	118 (41)	39 (64)
BMI, kg/m^2	27.1 ± 4.5	27.5 ± 4.4	25.1 ± 4.4
Right side, n (%)	185 (53)	149 (52)	36 (59)
ASA classification, n (%)			
I	215 (61)	169 (58)	46 (75)
II	132 (38)	118 (41)	14 (23)
III	2 (1)	1 (1)	1 (2)
Osteotomy type, n (%)			
Medial opening wedge HTO	239 (69)	231 (80)	8 (13)
Medial closing wedge HTO	68 (19)	57 (20)	11 (18)
TDO	29 (8)	—	29 (48)
Sagittal HTO	13 (4)	—	13 (21)
Wedge size, mm			
Medial opening wedge HTO	9.9 ± 3.0	10.0 ± 3.0	8.0 (6.0-9.0)[c]
Medial closing wedge HTO	6.8 ± 2.2	6.6 ± 2.0	7.0 (5.9-12.0)[c]
TDO[b]	15.0 (15.0-18.0)[c]	—	15.0 (15.0-18.0)[c]
Sagittal HTO	11.0 (7.5-13.5)[c]	—	11.0 (7.5-13.5)[c]
Revision surgery, n (%)	24 (7)	19 (7)	5 (8)
Osteotomy, n	2	2	—
Nonunion, n	3	2	1
TKA, n	13	11	2
Arthroscopic debridement, n	4	2	2
Meniscectomy, n	1	1	—
MUA, n	1	1	—
Hardware removal, n (%)	194 (56)	150 (52)	44 (72)
Timing of hardware removal, y	1.1 ± 0.6	1.1 ± 0.6	0.9 ± 0.7

[a]Data are presented as mean ± SD unless otherwise indicated. ASA, American Society of Anesthesiologists; BMI, body mass index; HTO, high tibial osteotomy; MUA, manipulation under anesthesia; OA, osteoarthritis; TDO, tibial derotation osteotomy; TKA, total knee arthroplasty.

[b]Degrees of rotational correction are presented.

[c]Data are presented as median (interquartile range).

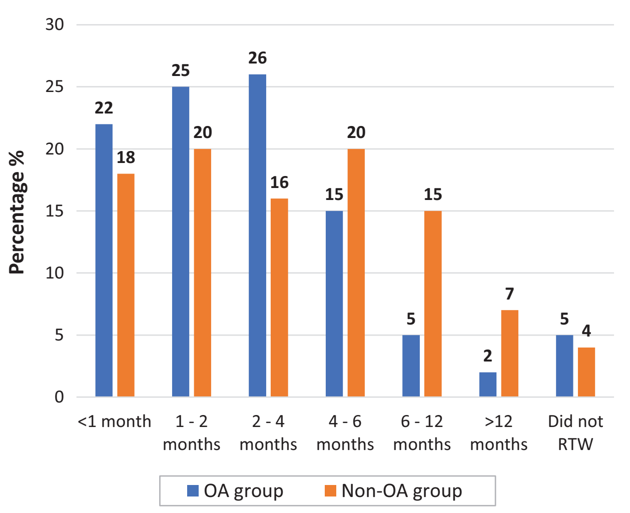

Figure 4. Timing of return to work for the osteoarthritis (OA) and non-OA groups.

no studies have investigated these effects in HTO, it is probable that the high surgeon volume (40-150 osteotomy procedures per year per surgeon) and high proportion of HTO procedures in our study positively influenced the outcomes.

Furthermore, much work has been done in recent years to standardize and optimize the HTO surgical technique. This includes more accurate preoperative planning methods and perioperative improvements, such as biplanar osteotomy,[32,37,44] use of angular stable implants,[8] and early full weightbearing mobilization.[4,25] As a result, survival rates and functional outcomes have markedly increased.[5,30]

Evidence on patient-related factors that influence RTW after HTO is extremely sparse.[15] Recent systematic reviews have described prognostic factors for RTW in patients of working age undergoing KA.[31,42] Our study is the first in patients undergoing HTO to include preoperative sick leave, and we found that it was associated with delayed and no RTW. Likewise, 3 studies found that preoperative sick leave was associated with worse RTW after KA.[31]

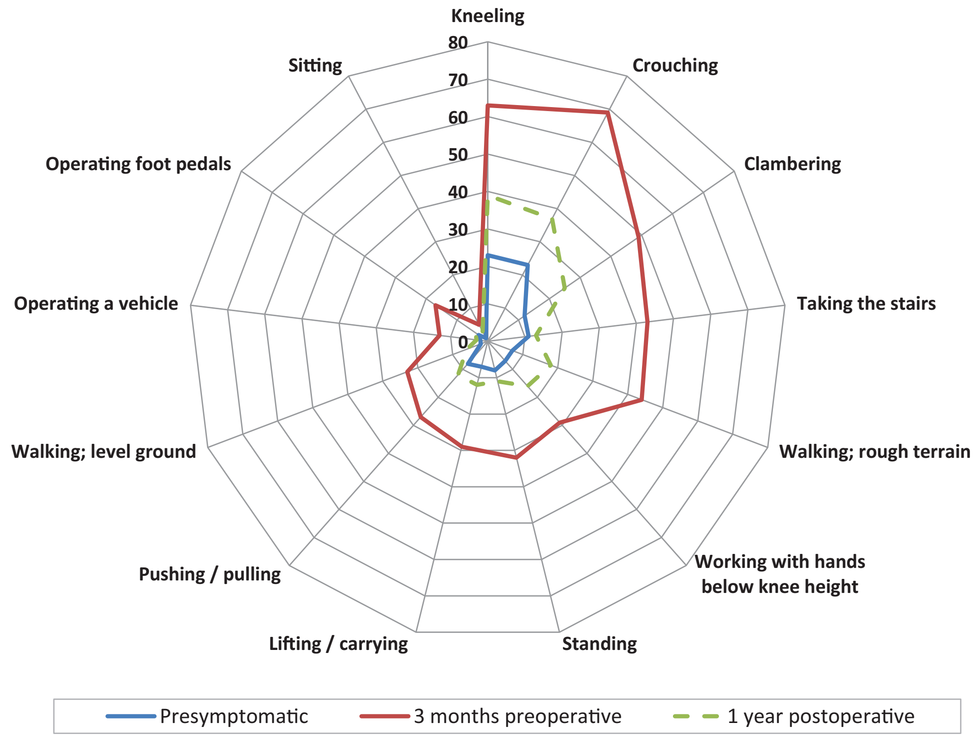

Figure 5. Reported difficulty with work-related tasks at 3 time points. The percentage of patients who experienced severe or extreme difficulty or were unable to perform the activity for each of the 13 activities is depicted.

Interestingly, being female was associated with no RTW in our cohort, which is in line with findings in patients undergoing KA.[20] Although no unequivocal explanation exists, one could speculate that women are less likely to be their family's breadwinner and therefore may decide more easily not to RTW.[20] The derotation osteotomy subgroup, with the highest percentage of female patients, was also associated with lower RTW at 6 months, supporting this hypothesis. Clearly, sex is an unmodifiable factor, and therefore, this finding should be mainly used to adequately inform patients. However, modifiable factors should be controlled as best as possible to lower the risk of delayed or no RTW after HTO. Preoperative sick leave was consistently found to be a predictor of delayed or no RTW after knee surgery, highlighting the need for better understanding reasons for being on sick leave. Possibly, adequate preoperative counseling and timely work-directed interventions, including referral to an occupational physician, could help to achieve this. Furthermore, earlier HTO surgery in these patients might be warranted to prevent the preoperative deterioration of functional status, resulting in delayed or no RTW.[20]

This study is the first to use a multivariable model to analyze the prognostic factors for RTW after HTO. Also, this is the first study to ask patients undergoing HTO about work-related factors such as employment status, being the family's breadwinner, preoperative sick leave, and intention to RTW. We hypothesized that both employment status and being the family's breadwinner would influence patients' motivation to RTW and therefore their actual RTW. Indeed, we found that being the family's breadwinner was most strongly associated with RTW within 6 months. Interestingly, this factor has never been studied in patients undergoing HTO or KA, hampering comparison with the current literature. In our cohort, employment status was not associated with RTW. In contrast, in KA, self-employment was an accelerating factor for RTW,[40] probably because of patients being highly motivated to start working again, being able to individually implement work adaptations, and of course, financial gains.

The association between workload and RTW after knee osteotomy remains debatable. Previous studies in patients undergoing HTO presented univariate analyses of the effect of workload on RTW, reporting conflicting findings.[15] There were 2 studies that found that higher workloads resulted in longer inability to work, while another study found no effect.[15] In patients undergoing KA, similar inconsistent findings have been reported,[13,31] with the study on the largest working cohort reporting no association.[13] Our univariate analysis found an association between higher workload and lower RTW, while the multivariable model showed lower RTW for patients with intermediate workloads compared with low workloads but no significant association between RTW and high workloads possibly because of a lack of power. Based on the literature and clinical reasoning, workload likely plays a role in time to RTW after knee surgery[15,20] because physically demanding jobs likely require better knee function and/or work adaptations to overcome the disability because of insufficient knee function. It is possible that our analysis of workload lacked power because of the small number of patients with

TABLE 2
Univariate Analysis of Factors Associated With RTW[a]

	RTW (n = 255)	No RTW (n = 44)	*P* Value
Age at surgery, y	47.6 ± 10.8	42.6 ± 12.5	**<.01**[b]
Follow-up, y	3.7 ± 1.0	3.5 ± 1.1	.19[b]
Female sex, n (%)	98 (38)	28 (64)	**<.01**[c]
BMI, kg/m^2	26.9 ± 4.0	28.1 ± 5.0	**.09**[b]
Right side, n (%)	136 (53)	23 (52)	.90[c]
ASA classification, n (%)			.41[c]
I	160 (63)	23 (52)	
II	93 (36)	21 (48)	
III	2 (1)	—	
Osteotomy type, n (%)			**.03**[c]
Medial opening wedge HTO	186 (73)	27 (62)	
Medial closing wedge HTO	48 (19)	8 (18)	
TDO	17 (7)	5 (11)	
Extending HTO	4 (1)	4 (9)	
Wedge size,[d] n (%)			**.07**[c]
<10 mm	119 (52)	26 (67)	
≥10 mm	108 (48)	13 (33)	
Employment status, n (%)			.24[c]
Employee	190 (75)	38 (87)	
Self-employed	54 (21)	5 (11)	
Both	11 (4)	1 (2)	
Breadwinner, n (%)			**<.01**[c]
Yes	180 (71)	21 (48)	
No	75 (29)	23 (52)	
Preoperative workload,[e] n (%)			**.02**[c]
Low	133 (55)	13 (32)	
Intermediate	73 (30)	20 (49)	
High	38 (15)	8 (19)	
Preoperative sick leave,[f] n (%)			**<.001**[c]
Yes	28 (11)	16 (38)	
No	226 (89)	26 (62)	
Preoperative intention to RTW,[g] n (%)			.20[c]
Yes	250 (98)	40 (95)	
No	4 (2)	2 (5)	

[a]Data are presented as mean ± SD unless otherwise indicated. Variables with a significance of $P < .10$ were considered significant and are presented in bold. ASA, American Society of Anesthesiologists; BMI, body mass index; HTO, high tibial osteotomy; RTW, return to work; TDO, tibial derotation osteotomy.
[b]Independent-samples *t* test.
[c]Chi-square test or Fisher exact test in cases with <5 expected counts.
[d]Wedge size could not be retrieved from the electronic patient record in 33 patients.
[e]Preoperative workload could not be determined in 14 patients.
[f]Preoperative sick leave was not reported in 3 patients.
[g]Preoperative intention to RTW was not reported in 3 patients.

intermediate and high workloads who did not RTW. Another explanation could be the healthy worker effect. This effect implies that patients who still perform heavy knee-demanding work before KA are a select group of workers who are more fit than workers involved in medium knee-demanding jobs.[20] Unfit workers would have already left their heavy knee-demanding job at an earlier phase because of health complaints.[20] However, based on our data, we cannot convincingly confirm the assumption that having a physically demanding job is associated with worse RTW 6 months after HTO.

The most important limitation of the present study is its retrospective design, with data collection at a mean follow-up of 3.6 years, which makes our findings prone to recall bias. However, given the importance of RTW, most patients can probably adequately estimate their RTW date.[2] Next, despite including the largest cohort of working patients undergoing HTO to date, the low number of patients who did not RTW may limit the power of our regression model. Furthermore, we were unable to present separate logistic regression analyses for the OA and non-OA groups. Consequently, the use of our prognostic factors when counseling individual patients, that is, OA or non-OA groups, might be hampered. Future studies including even larger cohorts are required to analyze prognostic factors for these groups separately. In addition, our study did not include a KA control group. Also, all HTO procedures were performed by high-volume knee osteotomy surgeons at a

TABLE 3
Logistic Regression Model Analyzing the Effect of Selected Covariates on the Odds of RTW[a]

	Odds Ratio	95% CI
BMI, kg/m^2	0.93	0.86-1.01
Wedge size, mm	1.41	0.60-3.31
Breadwinner	**2.92**	**1.27-6.69**
Preoperative sick leave	**0.20**	**0.08-0.46**
Preoperative workload		
Light	—	—
Intermediate	**0.40**	**0.17-0.97**
High	0.53	0.17-1.69

[a]Values with a significance of $P < .05$ were considered significant and are presented in bold. BMI, body mass index; CI, confidence interval; RTW, return to work.

single dedicated clinic. Consequently, the external validity of the present findings might be limited. However, adherence to the basic principles of patient selection, preoperative and intraoperative surgical planning, adequate plate fixation, and early rehabilitation likely result in improved and more homogeneous results in HTO surgery in different settings. Last, external validity may also be hampered because of differences in disability insurance policies between countries, as longer availability of workers' disability compensation could lead to slower RTW.

Patients with knee OA themselves are aware that proper RTW advice is lacking in the preoperative phase.[1] Consequently, patients are unsure about what to expect regarding their postoperative RTW and often await regular follow-up appointments to receive permission to RTW.[1] Studies have shown that thorough preoperative patient education results in improved postoperative outcomes after different orthopaedic procedures.[17] Thus, orthopaedic surgeons can play a crucial role in improving patient-related outcomes after HTO by preoperatively discussing expectations and recommendations, including adequate referral to occupational physicians. Such patient education, which should include advice regarding RTW, may be based on the present findings as well as previously reported expectations and outcomes of HTO.[12,15] Ultimately, the goal is for the surgeon to select the right patient at the right time to further improve satisfaction rates and patient-relevant outcomes after HTO.

CONCLUSION

In total, 95% of patients returned to work after HTO, and 9 of 10 patients returned within 6 months. Being the family's breadwinner was associated with RTW within 6 months, while preoperative sick leave was associated with RTW later than 6 months or even no RTW.

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APPENDIX

TABLE A1
Weekly Working Hours at 3 Time Points[a]

	Preoperative		1 y		Final Follow-up	
	OA	Non-OA	OA	Non-OA	OA	Non-OA
0-8 h	3	7	2	—	2	—
9-16 h	7	11	7	2	8	4
17-24 h	9	11	9	20	9	11
25-32 h	18	24	16	27	13	18
33-40 h	31	29	32	29	32	40
>40 h	32	18	26	13	22	18
Did not work	—	—	8	9	14	9

[a]Data are presented as %. OA, osteoarthritis.