



Surgeons' expectations of osteotomies around the knee

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Abstract

Introduction High tibial osteotomy (HTO) is a valid and joint preserving surgical technique to treat medial degenerative osteoarthritis (OA) in young and active patients. A recent study shows that patients' expectations of osteotomy around the knee are high, but OA progression and potential conversion to a total knee arthroplasty (TKA) were underestimated. The aim of this study was to investigate surgeons' expectations of HTO and to compare the results to the patients' expectations and actual outcomes reported in the literature.

Methods 461 surgeons were questioned online using the 'Hospital for Special Surgery Knee Surgery Expectations Survey (HFSS-KSES)' and a ten-item non-validated questionnaire to investigate the expectations of HTO. Two subgroups were formed to investigate differences regarding the surgeons' experience. Statistical analysis was performed using IBM SPSS Statistics.

Results Surgeons' expectations of HTO were rated between very and little important with pain reduction being the most important item on the HFSS-KSES. Furthermore, 'improving the ability to walk', 'to perform daily activities', 'having confidence in the knee', and 'avoiding future degeneration' were rated of high importance. An important difference regarding the experience was the lower expectations on delay/prevention of TKA of less-experienced surgeons.

Conclusion Surgeons' expectations of HTO are high but nevertheless different to the patients' expectations reported in the literature. Also, expectations for the delay/prevention of TKA differed regarding the experience of surgeons. While pain reduction represents one of the most important items for surgeons and patients, the expected outcome regarding the delay/prevention of a TKA and returning to sports differs to the patients' expectations and to the actual outcome reported in the literature. This should be considered when performing the preoperative informed consent.

Keywords HTO · High tibial osteotomy · Malalignment · Osteoarthritis · Expectation

Introduction

High tibial osteotomy (HTO) is a valid surgical technique to treat medial degenerative osteoarthritis (OA) with varus malalignment by shifting the load to the lateral compartment through slight overcorrection [1, 3, 4, 17]. It is an effective and joint preserving procedure, especially in the young and active patient with mild unicompartmental OA [8, 18, 21, 25]. Plenty of studies show good long-term survival and clinical outcomes following HTO, as for example pain relief, return to work and sporting activities. [5, 15, 16, 19, 20, 22]. Patients' satisfaction with surgery is rating between 77 and 98% [16]. It is known that the postoperative satisfaction is influenced by preoperative expectations and that, furthermore, unrealistic expectations of therapy can lead to dissatisfaction [2, 12, 13]. A recent study shows that

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patients' expectations of osteotomies around the knee are high in terms of capacity to work, restoring functions and the relief of pain, and the progression of osteoarthritis as well as the potential need for conversion to a total knee arthroplasty (TKA) was underestimated [6]. This highlights the need for an optimal preoperative interaction between patient and surgeon to form realistic expectations for a satisfying outcome [13]. For ACL reconstruction, there is evidence that patients' and surgeons' expectations do not differ, and that the actual outcome shows no difference to both patients' and surgeons' expectations [26]. To our knowledge, there is no evidence about surgeons' expectations on osteotomies around the knee so far.

The aim of this study was to investigate the expectations of orthopaedic and trauma surgeons of HTO. Furthermore, the postoperative treatment and the recommendations in terms of returning to sports were investigated and all results were compared to the literature. We assumed that there would be no difference between the surgeons' expectations of HTO on the one hand and the patients' expectations of osteotomy around the knee, as well as the outcome of HTO reported in the literature, on the other hand. Furthermore, we hypothesised that less experienced HTO surgeons would have different expectations than surgeons performing more HTOs.

Materials and methods

Study sample

A total of 461 surgeons, all members of the German speaking society for arthroscopy and joint surgery (AGA), completed an online questionnaire regarding their demographic data, their expertise and expectations concerning HTO. Most of the population was at least a specialist, 46% were proving a work experience of more than 15 years. The average age was 48.1 ± 8.6 years. 53.5% carried out up to 10 or no osteotomies at all per year (see Table 1, Figs. 1 and 2). Based on the lower experience of more than half of the study sample, two subgroups were formed [≤ 10 osteotomies/year = less experienced surgeons ($n = 247$) and > 10 osteotomies/year = higher experienced surgeons ($n = 215$)] to investigate differences concerning surgeons' expectations depending on their experiences with HTO.

Survey of surgeons' expectations

Surgeons' expectations were rated using the twenty-item 'Hospital for Special Surgery Knee Surgery Expectations Survey (HFSS-KSES)'. This represents a valid and reliable instrument that was developed patient-derived, especially for surgeries around the knee. Items are rated on a

Table 1 Demographic data of the study population (age [years], gender [% (*n*)], position [%(*n*)])

Age [years]	
Mean \pm SD	48.1 \pm 8.6
Min; max	30; 80
Sex % (<i>n</i>)	
Male	93.9% (433)
Female	6.1% (28)
Total	100.0% (461)
Position [% (<i>n</i>)]	
Head physician	22.6% (104)
Senior physician	26.9% (124)
Practice partner	13.9% (64)
Specialist for orthopedics	9.5% (44)
Assistant physician	1.1% (5)
Missing answer	26.0% (120)
Total	100.0% (461)

five-point Likert scale (1 = very important, 5 = this does not apply to me) and it requires less than 5 min to complete [11] (compare Table 2).

Additionally, a ten-item non-validated questionnaire was used to specifically investigate expectations of HTO. This questionnaire was slightly modified from a previous patients' expectations study [6]. It refers to expectations on returning to work after surgery (distinguishing between office and physical work) (1–3), returning to sports or recreational activities (4), expected residual pain (5) and differences between the operated and a healthy knee joint (6), delay/prevention of a TKA (7) and questions on the expected plate disturbances in daily life, the aiming for plate removal as well as the question if the removal will lead to further improvement in knee function (8–10) (see Table 3).

To assess the postoperative treatment, a non-validated, eight-item questionnaire was conducted, referring to time and range of restriction of range of motion (ROM), time of recommended partial weightbearing and recommendations considering the return to sports (Table 4).

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics for Windows (Version 27.0). Descriptive analysis of the data was performed by determining the percentages and if adequate, the mean of data. For the subgroup analysis, we performed a Mann–Whitney *U* test for the ordinal scaled items and an independent *t* test for the metric items to investigate differences. Before performing the *t* test, normal distribution was proven by using the Kolmogorov–Smirnov test. Significant difference was set for $p \leq 0.05$.

Fig. 1 Demographic data of the study population (number of osteotomies around the knee [n] performed per year [%])

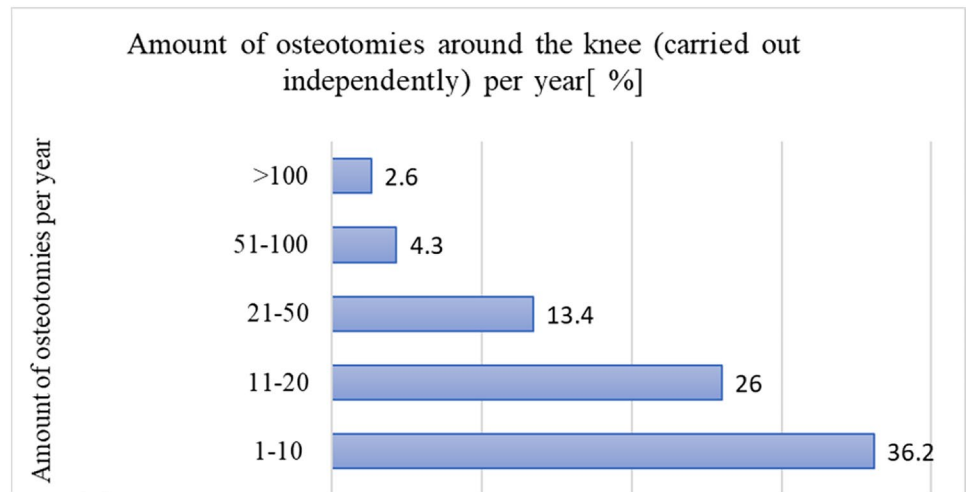
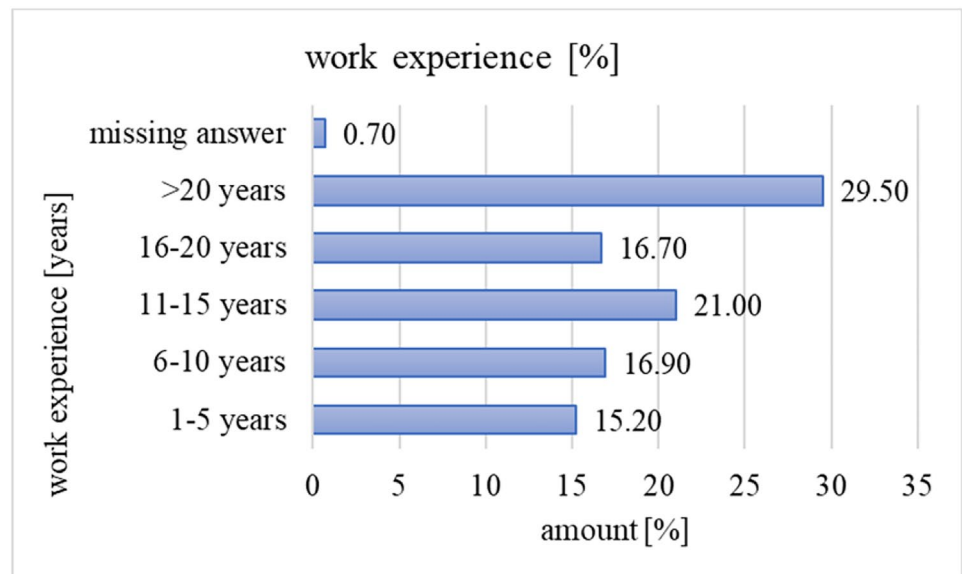


Fig. 2 Demographic data of the study population (amount of work [%] /experience [years])



Results

Surgeons' ratings of the aimed outcomes of osteotomy around the knee (HFSS-KSES)

In general, surgeons' expectations of HTO were rated between very and a little important (see Table 2). The reduction of pain was the most important item on the HFSS-KSES score being rated with 1.17. Other items showing high importance were 'improving the ability to walk, to perform daily activities as well as having confidence in the knee, returning to work and avoiding future degeneration'. Participating in sports was rated less important (see Table 2).

Surgeons' expectations on osteotomy around the knee

Regarding the pain reduction, only 2.2% of the questioned surgeons expected that patients would have no pain postoperative, regardless the performed activity. 35.8% expected occasional pain in demanding sports activities with contact/jumping aspects and 50.8% in less demanding sports activities. 11.3% expected their patients to have occasional pain in light physical activities or daily routine in house and garden (see Table 3).

Considering the return to work, more than 90% expected their patients to return to work on the same level without or with small limitations if having an office employment.

Table 2 Surgeons' priorities of expectations of high tibial osteotomy (HTO) according to the Hospital for Special Surgery Knee Surgery Expectations Survey (HFSS-KSES)

	Total sample (less/higher experienced surgeons)		Sum % (<i>n</i>)				
	<i>N</i>	Mean	1 very important	2 somewhat important	3 A little important	4 I do not expect this	5 This does not apply to me
Pain reduction	459 (247/212)	1.17 (1.18/1.15)	84.1% (386)	15.5% (71)	0.0% (0)	0.4% (2)	0.0% (0)
Improve ability to walk	460 (246/214)	1.51 (1.48/1.55)	52.0% (239)	45.9% (211)	1.3% (6)	0.9% (4)	0.0% (0)
Increase knee stability	461 (247/214)	2.46 (2.41/2.51)	8.7% (40)	47.9% (221)	32.75% (151)	10.4% (48)	0.2% (1)
Increase knee mobility	460 (246/214)	2.77 (2.67/2.87)*	5.0% (23)	32.2% (148)	44.8% (206)	17.4% (80)	0.7% (3)
Improve ability to go up and down stairs	460 (246/214)	2.01 (1.95/2.08)*	18.3% (84)	65.0% (299)	14.4% (66)	2.4% (11)	0.0% (0)
Improve ability to squat	460 (246/214)	2.82 (2.74/2.92)*	3.9% (18)	26.7% (123)	53.0% (244)	15.7% (72)	0.7% (3)
Improve ability to kneel	459 (245/214)	3.01 (2.96/3.07)	4.1% (19)	18.7% (86)	49.9% (229)	26.4% (121)	0.9% (4)
Stop knee from catching or buckling	460 (246/214)	2.19 (2.11/2.29)	24.1% (111)	44.4% (204)	20.4% (94)	10.2% (47)	0.9% (4)
Stop knee from giving away when coming to a quick stop while running	460 (246/214)	2.44 (2.37/2.51)	12.6% (58)	45.0% (207)	29.4% (135)	12.4% (57)	0.7% (3)
stop knee stiffness or swelling	459 (245/214)	2.05 (2.04/2.06)	19.0 (87)	61.0% (280)	16.1% (74)	3.9% (18)	0.0% (0)
To be employed for monetary reimbursement	455 (243/212)	1.57 (1.58/1.56)	49.2% (224)	45.3% (206)	5.1% (23)	0.4% (2)	0.0% (0)
Improve ability to run (for example across the street, to catch a bus)	459 (245/214)	2.43 (2.47/2.38)	6.8% (31)	49.0% (225)	39.2% (180)	4.6% (21)	0.4% (2)
Improve ability to perform daily activities (for example household chores, daily routine)	459 (245/214)	1.53 (1.58/1.47)	51.6% (237)	44.2% (203)	3.7% (17)	0.4% (2)	0.0% (0)
Improve ability to exercise or participate in sports	459 (245/214)	2.30 (2.29/2.32)	8.9% (41)	56.0% (257)	31.1% (143)	3.7% (17)	0.2% (1)
Have confidence in knee	456 (243/213)	1.53 (1.53/1.54)	51.1% (233)	45.0% (205)	3.5% (16)	0.4% (2)	0.0% (0)
Avoid future degeneration of knee	459 (245/214)	1.94 (1.91/1.97)	30.9%(142)	49.0% (225)	15.5% (71)	4.6% (21)	0.0% (0)
Improve ability to maintain general health	459 (245/214)	2.09 (2.13/2.05)	21.8% (100)	53.6% (246)	18.3% (84)	6.3% (29)	0.0% (0)

Table 2 (continued)

	Total sample (less/higher experienced surgeons)		Sum % (<i>n</i>)				
	<i>N</i>	Mean	1 very important	2 somewhat important	3 A little important	4 I do not expect this	5 This does not apply to me
Improve ability to interact with others (for example, to take care of someone, play with children)	459 (245/214)	2.09 (2.07/2.11)	23.5% (108)	50.5% (232)	20.3% (93)	5.0% (23)	0.7% (3)
Improve psychological well-being	457 (244/213)	1.84 (1.83/1.84)	36.1% (165)	47.7% (218)	13.1% (60)	2.6% (12)	0.4% (2)
For knee to be back the way it was before this problem started	460 (246/214)	2.79 (2.76/2.83)	7.8% (36)	37.4% (172)	26.1% (120)	25.2% (116)	3.5% (16)

Results are presented in [% (*n*)]. Significant differences between the two subgroups (less/higher experienced surgeons) concerning the mean values are marked with * ($p \leq 0.05$). The items with highest rating are highlighted bold

For physical work, almost 90% expected to return on the same level with small limitations or to return to work on a slightly lower level (see Table 3). The expected average time for returning to work was 6.3 ± 2.7 weeks for office work, 10.8 ± 3.8 weeks for light/moderate physical work, 16.7 ± 6.2 weeks for heavy and 21.2 ± 5.2 weeks for heaviest physical work.

For daily activities, surgeons expected mainly slight or moderate disturbances (92.2%). Concerning the delay of knee prosthesis, 95.8% expected to a delay of minimum 6–9 years (see Table 3). Regarding level of sporting activity, only 5% of the questioned surgeons expected patients to have no limitations when returning to sporting activity. They mainly expected their patients to return on to the same level as with an uninjured knee with small limitations (34.3%) or on a slightly lower level (49.7%), 11.1% expected their patients to return to a lower level.

Surgeons' expectations depending on their experience

The ratings of the HFSS-KSES showed some significant differences between less and higher experienced surgeons. The items 'increase knee mobility' ($p=0.006$), 'improve ability to go up and down stairs' ($p=0.047$) and 'improve ability to squat' ($p=0.005$) were rated more important of the less experienced surgeons than of the higher experienced surgeons' (compare Table 2). The highest rated items 'pain reduction' ($p=0.635$), 'improvement of ability to walk' ($p=0.130$), 'have confidence in the knee' ($p=0.880$), 'perform daily activities'

($p=0.065$) and 'restoring working capacity' ($p=0.733$) did not show any differences between the two subgroups.

For the surgeons' expectations, a significant difference could be shown between less- and higher experienced surgeons' expectations concerning the delay/prevention of a TKA ($p=0.005$). Less experienced surgeons were more reluctant. Detailed information is presented in Table 3. Other significant differences appeared concerning the osteosynthesis material. Less experienced surgeons expected the material to be less disturbing ($p=0.000$) while higher experienced surgeons expected patients to want the plate removed ($p < 0.001$), and the removal to further improve the knee function ($p=0.018$). Results are presented in Table 3.

Postoperative treatment and recommendations

Concerning the postoperative treatment, 80% of the surgeons do not set restrictions on the range of motion (ROM), but recommend partial weight bearing for up to 6 weeks postoperative (52%). Almost 90% of the surgeons give recommendations on the return to sports, 59.2% considering both radiographic results and functional results, the rest considering either one. Almost 70% do not recommend knee-demanding sports like basketball, soccer, American football, rugby, handball, ice hockey, boxing after rehabilitation one year postoperative. For detailed information, compare Table 4.

Table 3 Non-validated ten-item questionnaire of surgeons' expectations of high tibial osteotomy (HTO)

	Total sample [less/higher experienced surgeons] % (n)	p Value (less vs. higher experienced surgeons)
1. What do you expect of an osteotomy regarding the return to work for an office work?		
Return to work on the same level as with an unharmed knee, without limitations	47.3%(218) [48.2%(119)/46.3%(99)]	0.891
Return to work on the same level as with an unharmed knee, with small limitations	44.7%(206) [41.7%(103)/48.1(103)]	
Return to work on a slightly lower level	7.6%(35) [9.3%(23)/5.6%(12)]	
Return to work on a much lower level	0.4%(2) [0.8%(2)/0%(0)]	
2. What do you expect of an osteotomy regarding the return to work for a physical work?		
Return to work on the same level as with an unharmed knee, without limitations	9.5%(44) [9.3%(23)/9.8%(21)]	0.177
Return to work on the same level as with an unharmed knee, with Small limitations	51.0%(235) [48.2%(119)/54.2%(116)]	
Return to work on a slightly lower level	36.9%(170) [39.3%(97)/34.1%(73)]	
Return to work on a much lower level	2.6%(12) [3.2%(8)/1.9%(4)]	
3. How many weeks of inability to work do you expect for the Patients with the following working profile?		
Office work	Mean ± SD [weeks] 6.3 ± 2.7 [6.3 ± 2.9/6.4 ± 2.5]	0.680
Light/moderate physical activity (e.g. climbing stairs and ladders, lifting loads)	10.8 ± 3.8 [10.8 ± 4.1/10.8 ± 3.6]	0.972
Heavy physical activity (e.g. carrying 20–30 kg heavy loads, shovelling, digging, hacking)	16.7 ± 6.2 [16.7 ± 6.3/16.6 ± 6.1]	0.963
Heaviest physical work (e.g. carrying > 50 kg heavy loads, heaviest pulling/pushing)	21.2 ± 5.2 [21.0 ± 5.4/21.4 ± 5.1]	0.420
Returning to sports on the same level as it was possible with an unharmed knee, without limitations	5.0%(23) [5.3%(13)/4.7%(10)]	0.877
Returning to sports on the same level as it was possible with an unharmed knee, with small limitations	34.3%(158) [34.8%(86)/33.6%(72)]	
Returning to sports on a slightly lower level	49.7%(229) [47.0%(116)/52.8%(113)]	
Returning to sports on a clearly lower level	11.1%(51) [13.0%(32)/8.9%(19)]	
5. What do you expect from the osteotomy in terms of residual pain?		
Not a bit of pain, independent of activity	2.2%(10) [2.4%(6)/1.9%(4)]	0.582
Occasional pain in demanding sports activities with contact/jumping aspects (e.g. basketball, soccer, American football, rugby, handball, ice hockey, boxing)	35.8%(165) [36.0%(89)/35.5%(76)]	
Occasional pain in less demanding sports activities (e.g. volleyball, canoeing, rock climbing, windsurfing/surfing, alpine skiing, cross-country skiing, judo, weightlifting)	50.8%(234) [51.4%(127)/50.0%(107)]	
Occasional pain in light physical activities or daily routine in house and garden	11.3%(52) [10.1%(25)/12.6%(27)]	
6. Compared to a healthy knee joint, what do you expect from your operated knee joint after surgery?		
A fully restored joint (no differences to a healthy knee joint)	2.8%(13) [2.0%(5)/3.7%(8)]	0.777
An almost fully restored joint (minimal differences to a healthy knee joint)	69.6%(321) [71.7%(177)/67.7%(144)]	
Abnormal joint conditions (noticeable differences to a healthy knee joint)	27.3%(126) [25.9%(64)/29.0%(62)]	
Clearly abnormal joint conditions (pronounced differences to a healthy joint)	0.2%(1) [0.4%(1)/0%(0)]	
7. Do you expect that an osteotomy can delay/prevent a total knee prosthesis?		

Table 3 (continued)

	Total sample [less/higher experienced surgeons] % (n)	p Value (less vs. higher experienced surgeons)
I expect that a knee prosthesis will be prevented fully	3.0%(14) [2.8%(7)/3.3%(7)]	
I expect a delay of 10–15 years	55.5%(256) [50.2%(124)/61.7%(132)]	
I expect a delay of 6–9 years	37.3%(172) [40.5%(100)/33.6%(72)]	
I expect a delay of 1–5 years	3.3%(15) [4.9%(12)/1.4%(3)]	
I do not expect that osteotomy will prevent total knee prosthesis	0.9%(4) [1.6%(4)/0%(0)]	
8. Do you expect that the plate will disturb the patients in their daily life?		
Not at all	6.9%(32) [9.3%(23)/4.2%(9)]	0.00*
Slight, easy to tolerate disturbances during daily activities	54.7%(252) [59.1%(146)/49.5%(106)]	
Moderate disturbances during daily activities	37.5%(173) [30.8%(76)/45.3%(97)]	
Strong disturbances during daily activities	0.9%(4) [0.8%(2)/0.9%(2)]	
9. Do you expect that your patients are going to want to have the plate removed?		
Yes	91.8%(423) [87.9%(217)/96.3%(206)]	0.001*
No	8.2%(38) [12.1%(30)/3.7%(8)]	
10. Do you expect that the removal of the plate will further improve the knee function (release of residual restrictions)		
Yes	70.3%(324) [65.6%/162/75.7%(162)]	0.018*
No	29.7%(137) [34.4%(85)/24.3%(52)]	

Results are presented in [% (n)] for the total sample as well as the subgroups [less/higher experienced surgeons]. *p* values for the Mann–Whitney *U* test (ordinal values, questions number 1,2,4–10) and independent *t* test (metric values, question number 3) are indicating significant differences between the two subgroups if $p \leq 0.05$ (marked with*)

Discussion

All in all surgeons' expectations of HTO are high, the most important item being relief of pain. Further important are functional aspects like the improvement of ability to walk, having confidence in the knee, performing daily activities and restoring working capacity. For those items, there were no significant differences between the ratings of less experienced and higher experienced surgeons. For surgeons' expectations, the most relevant significant difference regarding the experience appeared for the item 'delay/prevention of a TKA'. The expectations of returning to work and sports, as well on pain relief and knee function did not differ between less experienced and higher experienced surgeons.

Relief of pain was already mentioned in early literature as a main indication for HTO [4]. In the present study, it indicates to be of highest importance for surgeons, and there is evidence in the literature that it is also of highest importance for patients. The former mentioned study of Grünwald et al. on patients' expectations enrolled a total of 264 patients using the HFSS-KSES, and a similar 10-item non-validated questionnaire about expectations of osteotomies around the knee as we did in the present study. Relief of pain was rated in the HFSS-KSES by patients with a mean of 1.23

compared to 1.17 by the surgeons in the present study [6]. The results of the non-validated questionnaire on expectations of HTO show that surgeons expect more residual pain in less demanding sports (50.8%) than patients did in the former study (33%), and that patients expected more absence of pain independent of the activity d (23%) than surgeons did (2.2%) [6]. There is evidence in the literature that pain can be successfully reduced [1, 5, 7, 16, 19]. However, all of the mentioned studies asked for pain in general, using the visual analogue scale (VAS) [1, 5, 7, 19], instead of asking for activity-related pain. Pain reduction is important for both surgeons and patients regardless of the surgeons' experience of HTO. Nevertheless, the actual expectations show a deviation where further investigations are necessary to find out about the activity-related degree of pain relief to have good evidence for preoperative preparation of patients.

As mentioned earlier, osteotomy around the knee is a treatment recommended for young and active patients [9, 18, 21, 24]. Corresponding, there is a high patients' expectation for returning to work and sports [6]. Returning to work was rated important by surgeons in the present study as well, showing no difference between less experienced and higher experienced surgeons. Current literature gives evidence for a return to work rate to the same

Table 4 Non-validated questionnaire about surgeons' postoperative recommendations after high tibial osteotomy (HTO)

	Sum [% (n)]		
Do you set restrictions on the postoperative range of motion?			
Yes	19.1% (88)		
No	80.9% (373)		
If yes, for what period of time?			
1–3 weeks	10.8% (50)		
1–6 weeks	10.6% (49)		
No limitations	78.5% (362)		
How do you apply restrictions on range of motion?			
	60°Flexion	90°Flexion	No restriction
1–3 weeks	9.2% (42)	14.9% (68)	76.0% (348)
3–6 weeks	0.2% (1)	11.5% (51)	88.3% (393)
Do you recommend a partial weightbearing (10–20 kg) postoperative for the operated knee?			
Yes	95.2% (439)		
No	4.8% (22)		
If yes, for what period of time?			
2 weeks	15.2% (70)		
4 weeks	28.2% (130)		
6 weeks	51.8% (239)		
No partial load	4.8% (22)		
Do you give a recommendation concerning return to sports?			
Yes	87.4% (403)		
No	12.6% (58)		
What are these recommendations based on?			
Radiography	21.5% (99)		
Function of knee joint, muscle strength, pain	19.3% (89)		
Both mentioned criteria	59.2% (273)		
What kind of sports do you not recommend after rehabilitation (a year postoperative)?			
Knee-demanding sports (e.g. basketball, soccer, American football, rugby, handball, ice hockey, boxing)	68.6% (316)		
Partly knee-demanding sports (e.g. volleyball, canoeing, sports-climbing, windsurfing, surfing, alpine skiing, cross-country skiing, judo)	12.2% (56)		
Sports that are not knee-demanding (e.g. cycling, swimming, rowing)	5.0% (23)		
I do not give a recommendation	13.0% (60)		

Results are presented in [% (n)]

level of at least 90% [5, 19, 23], even for physical work. These findings are matching patients' expectations, where 67% expected a return to work on the same level without limitations [6]. In the current study, surgeons were a bit more reluctant for returning to physical work. While 60% expected their patients to return to their physical work, only 9.5% expected so without limitations. Schröter et al. found a relation between incapacity to work and work load ranging from a median of 42 days for office work to 120 days for moderate and most heavy work [23]. This matches with the expectations in the present study expecting 6 weeks of working incapacity for office work and 21 weeks for most heavy work. Data from Faschingbauer et al. also support these findings, though by using another

work-intensity classification (12 weeks for office or light physical work, 20 weeks for heavy and most heavy work).

Returning to sports was rated less important by surgeons in the present studies than it was in the patients' expectations studies [6], again showing no difference between less and higher experienced surgeons. Having a closer look, most surgeons expected their patients to return to the same level with limitations (34.3%) or even on a lower sports level (49.7%) while more patients expected to return on the same level without limitations (23%) [6]. 87.4% of the surgeons reported to give recommendations concerning postoperative return to sport, almost 70% did not recommend knee-demanding sports. Comparing the expectations with the reported evidence in literature, the 'return to sports rate' is

indeed more than 85% in young and active populations [5, 20, 22]. A reported shift from high- to low-impact sports [5] supports the surgeons' expectations. Salzman et al. [20], however, made a difference between lifetime, pre- and postoperative sports and reported a decrease of high-impact sports from lifetime to pre- and postoperative, but not between pre- and postoperative. On top of that, there is evidence about a significant impact of motivation on the return to strenuous sports postoperative [2, 22]. A preoperative individual assessment of the patients' requirement, as for example physical aspects and motivation, is necessary to give a realistic recommendation on returning to sports.

The progress of OA and potential need for conversion to total knee arthroplasty (TKA) is underestimated by patients undergoing an osteotomy around the knee [6]. A total prevention of TKA was only expected by 3% of the surgeons in the present study while 32% of patients expected so in the former study [6]. In general, despite the relatively low evidence presented in literature, HTO seems to be a good option for delaying arthroplasty for more than 15 years in the majority of patients, the 5-, 10-, 15- and 20-year survival rates, mainly defined as no conversion to TKA over time, ranging from 86–100%, 64–97.6%, 44–93.2% and 46–85.1% [16]. While population-based studies identified a 10-year survival rate of 70–73% [15, 25], single surgeon or hospital-bound studies indicate better survival times: 94% at 5 years, 79.9% at 10 years and 65.5% at 15 years, respectively [7] and 95% at 5 years, 79% at 10 years and 56% at 15 years for patients with a potential risk factor OA Grade IV [9]. Other studies showing even better results (after 5-, 10-, 15- and 20 years 98%, 92%, 82% and 79%) have to be seen critically because of high dropout rates [1] and a comparatively young (45.8 ± 9.5 years) and small population (31 knees) [10], while higher age has been identified as a potential risk factor concerning survival time [7, 9]. All in all, HTO shows sufficient long-term outcomes, but with the longest follow-up being 20 years [1], no statements about lifetime-survival can be made. Nevertheless, the high expectations of patients and surgeons concerning delay/prevention of TKA compared to the outcome presented in the literature should be an indication to put more focus on this topic when deciding for HTO. Another important finding was the significant difference regarding the surgeons' experience concerning their expectation for delay/prevention of TKA. Our findings indicate higher expectations of more experienced surgeons. Further studies should investigate if the experience of the surgeon influences the long-term outcome of HTO.

There is evidence that the osteosynthesis material can cause local irritations and that plate removal may cause a significant further improvement in function [14]. In the present study, higher experienced surgeons expected more irritations because of the plate and a further functional improvement after plate removal than less experienced surgeons.

These findings suggest that higher experience might lead to a more realistic evaluation concerning complications, or even a better knowledge of evidence given in literature.

The literature shows high patients' expectations regarding capacity to work, pain relief and restoring knee function when undergoing osteotomy around the knee [6]. In the present study, we found that surgeons' expectations of HTO are also high, but deviate to the patients' expectations found in the former study. While both surgeons and patients find the aspects 'pain relief', 'improvement of ability to walk', 'have confidence in the knee' and 'restoring working capacity' important, patients rated the aspects 'avoiding future degeneration' and 'exercising' more important than surgeons. Also, the expectations regarding the return to sports, prevention of TKA and pain relief differed in some points, surgeons being more reluctant than patients. A main difference regarding the experience of surgeons appeared for the expectation on 'delay/prevention of TKA' while other relevant aspects did not show any differences between the two groups.

This study has several limitations. Comparing surgeons' expectations and patients' expectations was only possible by comparing two different studies which were based on the same questionnaires but conducted from different populations. Outcome was also investigated from the existing literature. Also, surgeons made a general assessment regarding their expectations of HTO. However, outcome is influenced by several individual factors, which makes it hard to formulate general expectations and might lead to the more reluctant expectations in the present study.

A limitation and strength at the same time is the large population and the diversity of questioned surgeons. The large part of less experienced surgeons (10 or less HTOs per year) can represent a limitation, but by performing a subgroup analysis to investigate potential differences between less and higher experienced surgeons it rather can be rated as a strength.

To get more evident results, further investigations are necessary. A study covering both surgeons' and patients' expectations from the same population and including a follow-up concerning the outcome and the satisfaction of both patients and surgeons would be a possible further approach.

Conclusion

Surgeons' expectations of HTO are high but nevertheless different to the patients' expectations reported in the literature. Also, expectations for the delay/prevention of TKA differed regarding the experience of surgeons; therefore, both our hypotheses cannot be proven completely.

Pain reduction represents one of the most important items for surgeons and patients. The expected outcome regarding

the delay/prevention of a TKA and returning to sports differs to the patients' expectations and to the actual outcome reported in the literature. This should be considered when performing the preoperative informed consent.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval Ethical approval was not necessary because an online survey among surgeons was performed and there was neither any patient contact nor any data from any patients were used or analyzed.

Informed consent Yes.

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