



ELSEVIER

Contents lists available at ScienceDirect

## The Journal of Arthroplasty

journal homepage: [www.arthroplastyjournal.org](http://www.arthroplastyjournal.org)

## Return to Sports After Total Hip Arthroplasty: A Survey Among Members of the European Hip Society

Martin Thaler, MD, MSc <sup>a</sup>, Ismail Khosravi, MD <sup>a,\*</sup>, David Putzer, PhD, MSc <sup>b</sup>, Klaus A. Siebenrock, MD <sup>c</sup>, Luigi Zagra, MD <sup>d</sup><sup>a</sup> Department of Orthopaedic Surgery and Traumatology, Medical University of Innsbruck, Innsbruck, Austria<sup>b</sup> Department of Orthopaedic Surgery, Experimental Orthopaedics, Medical University of Innsbruck, Innsbruck, Austria<sup>c</sup> Department of Orthopaedic Surgery, University of Bern, Bern Inselspital, Bern, Switzerland<sup>d</sup> IRCCS Istituto Ortopedico Galeazzi, Hip Department, Milan, Italy

## ARTICLE INFO

## Article history:

Received 27 August 2020

Received in revised form

27 October 2020

Accepted 5 November 2020

Available online xxx

## Keywords:

total hip arthroplasty

return to sports

arthroplasty

physical activity

recommendations for sport activities

European hip society

## ABSTRACT

**Background:** The study's aim was to summarize the recommendations given by members of the European Hip Society (EHS) regarding sport activities after total hip arthroplasty (THA).**Methods:** Members of the EHS were invited to complete an online web-based questionnaire including recommendations for 47 sports disciplines. The questions regarding the specific sports were also divided into 4 subcategories: "allowed," "allowed when experienced," "not allowed", and "no opinion." Four intervals for resuming the sports activities after THA were evaluated: within 6 weeks after THA, 6 to 12 weeks after THA, 12 weeks to 6 months after THA, and more than 6 months after THA. Consensus on resuming sports was analyzed.**Results:** A total of 150 (32.9%) EHS members participated in the survey. Agreement was found for 5 sports activities in the first 6 weeks after THA, for 10 activities, 6 to 12 weeks after surgery, for 26 activities, 3 to 6 months after THA, and for 37 of 47 activities, 6 months after surgery. Sports activities which were not allowed after THA were handball, soccer and football, basketball, full contact sports, and martial arts.**Conclusion:** This is the first report describing the recommendations of European hip arthroplasty surgeons on resuming sport activity after THA. Most physical activities were allowed for the patients 6 months after THA. The experience of the patient in performing a distinct sport activity did not influence the recommendations to return to former sports activities. European surgeons are progressively mitigating restrictions to sports after THA. Further studies should evaluate the effects of this trend on patients' outcome and implant survival.

© 2020 Elsevier Inc. All rights reserved.

Total hip arthroplasty (THA) is one of the most successful surgical interventions [1]. The numbers of procedures in younger patients are still increasing [2,3]. Patients undergoing THA in general

Conflict of interest statement: There are relationships/conditions/circumstances that present a potential conflict of interest with the submitted article.

Ethical review committee statement: Approval by an institutional review board was deemed unnecessary because no patient data were involved in the submitted article. This article does not contain any studies with human participants or animals performed by any of the authors.

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to <https://doi.org/10.1016/j.arth.2020.11.009>.

\* Reprint requests: Ismail Khosravi, MD, Medical University of Innsbruck: Medizinische Universität Innsbruck, Anichstraße 35, 6020 Innsbruck, Austria.

E-mail address: [ismail.khosravi@gmail.com](mailto:ismail.khosravi@gmail.com)

have a longer life expectancy and a decreasing age at the time of surgery [4,5]. Nowadays, even the aging population performs sports for a longer period of time than centuries ago [6]. People are performing sports to improve their health for well-being, and there is clear evidence that health benefits are gained from physical activities [7]. Sports activities also create opportunities for social interaction, being part of a community, developing relationships, attending competitions, achieving goals, and contributing to the overall sense of successful aging [6].

However, a return to sports activities is frequently limited by recommendations made by arthroplasty surgeons to avoid complications and concerns associated with sports activity after THA. In general, surgeons want to give their recommendations based on good evidence, but the current literature rarely reports on this subject. Major concerns associated with sports after THA are survival of the implant, dislocation, periprosthetic fracture, and implant wear [8]. However, over the past decades, surgical

techniques have been modified and improved, and muscle-sparing minimally invasive techniques have become increasingly popular [9,10].

In addition, the use of larger heads and developments in materials like cross-linked polyethylene and ceramics are assumed to have a positive impact on implant survival [2].

Current recommendations are based on personal preferences and surveys of surgeons. The practice of the American Association of Hip and Knee Surgeons (AAHKS), the Hip Society (HS) of Northern America, and the British Hip Society (BHS) in allowing patients who underwent THA to resume sports activities has been published [8,11,12]. However, 2 out of these 3 articles were published over a decade ago [8,12]. A survey of the BHS was recently published and reported on the recommendations for returning to sports after THA in young active patients. However, there is a well-known difference in THA practice between the United Kingdom and continental Europe [11,13]. Moreover, the recommendations focused solely on active young patients. One more limitation of the published studies is that they provide general recommendations and are disregarding the time interval after THA.

The aim of the present study was to investigate the recommendations for returning to sports after THA made by members of the European Hip Society (EHS) and to establish a guideline for returning to sports after THA for particular time periods.

## Materials

A web-based survey (SurveyMonkey, [www.surveymonkey.com](http://www.surveymonkey.com), Portland, OR, USA) was sent to all 510 members of the EHS as an e-mail invitation. The survey listed 47 different activities (Fig. 1), and the surgeons were asked to assign their recommendations for resumption after a primary THA to 1 of 4 categories: allowed, allowed when patient is experienced, not allowed, or no opinion. Participants were also asked for their recommendation for each activity, namely when to allow patients to return to sports activities for the following time periods: 6 weeks, 6 to 12 weeks, 12 weeks to 6 months, and after 6 months after surgery.

Data on surgeons' experience, health care facility status, specialization, surgical approach, preferred implant choice, preferred bearing surface, head size, and recommendations for driving a car again after THA were collected. In addition, recommendations for different types and duration of physical therapy were recorded. The surgeons were also asked about their own frequency of performing sports and their favorite sports activity.

Finally, the participants were asked to state what they feel is the greatest risk resulting from physical activity after primary THA.

## Statistical Analysis

A power analysis for a "1-sample proportion test" determined that approximately 64% of each of the mentioned 4 categories selected would be required to achieve statistical significance (power = 0.95) based on the number of survey respondents (N = 150). All survey results were tabulated, and percentage was calculated.

For each activity surveyed, the percentage of response for each category (allowed, allowed with experience, not allowed, and undecided) was compared with the percentage of response required for significance (64%) with a "Z-test". A "P value" of  $P = .05$  was considered statistically significant. The responses for allowed and allowed with experience were grouped and compared with the combined not allowed and undecided groups. If the combined allowed and allowed with experience group was significantly favored as compared with the combined not allowed and undecided group, the overall recommendation was declared "recommended." If the combined not allowed and undecided group was significantly favored as compared with the combined allowed and allowed with experience group, the overall recommendation was classed as "not recommended." If no statistical significance was achieved for either comparison, the overall recommendation was declared "undecided."

Pearson's chi-squared test was used to analyze the relationship between groups regarding sport activities, which were allowed. Likelihood ratio was used when the number of responses was less than 5. Participants with a higher activity level (sports more than twice a week) and participants with a lower activity level (sports less than twice a week) were compared. The relationship between head size and allowed was compared between head sizes smaller than or equal to 32mm (48%,  $n = 72$ ) and head sizes equal to or bigger than 36mm. Participants were divided into 4 groups considering the preferred surgical approach used for THA to assess the relationship between recommendations and surgical approach.

## Results

Out of 510 members of the EHS, 150 (30.6%) completed the survey. Of these, 66.7% stated that they perform more than 100

Endurance sports	Water sports	Mountaineering	Winter sports	Ball sports	Contact sports	Fitness training	Miscellaneous
Walking	Swimming	Hiking	Skiing	Tennis doubles	Tai Chi	Fitness / Weight lifting	Horseback riding
Walking stairs	Aqua fitness	Nordic walking	Cross-country skiing / Nordic skiing	Tennis singles	Full contact sports (e.g. boxing)	Cross-training	Extreme sports
Jogging	Surfing	Climbing	Snowboarding	Golf	Martial arts	Yoga	Dancing
Jogging on road	Windsurfing	Canyoning	Ice skating / skating	Squash		Aerobics	Bowling
Running	Sailing		Sledging	Badminton			
Running on a treadmill	Rowing			Table tennis			
Mountainbiking / incline cycling	Canoeing			Handball			
Cycling on even ground	Kayaking			Volleyball			
Static cycling				Soccer / Football			
				Basketball			

Fig. 1. List of 47 physical activities after primary THA investigated during the survey.

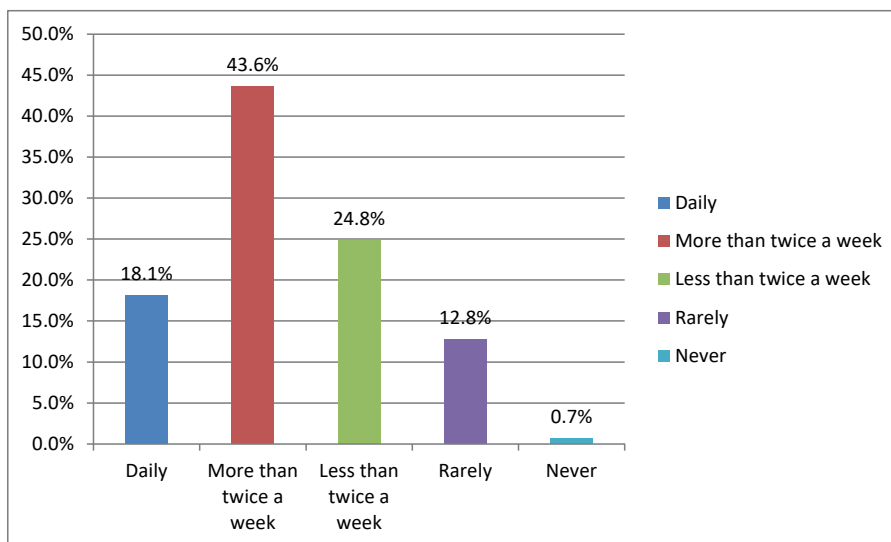


Fig. 2. Do orthopedic surgeons do sports?

**Table 1**  
Summary of Recommendations for Endurance Sports.

Follow-Up	Allowed	Allowed When Experienced	Not Allowed	No Opinion	z-test P Value	Recommendation
Walking						
6 wk	97%	2%	1%	0%	.001	Recommended
6-12 wk	97%	1%	0%	1%	.001	Recommended
12 wk to 6 mo	96%	1%	0%	3%	.001	Recommended
6 mo	93%	1%	0%	6%	.001	Recommended
Walking stairs						
6 wk	91%	9%	1%	0%	.001	Recommended
6-12 wk	95%	2%	1%	2%	.001	Recommended
12 wk to 6 mo	95%	1%	0%	5%	.001	Recommended
6 mo	93%	1%	0%	6%	.001	Recommended
Jogging						
6 wk	7%	15%	77%	1%	.001	Not recommended
6-12 wk	37%	21%	39%	3%	.15	Undecided
12 wk to 6 mo	70%	11%	15%	5%	.001	Recommended
6 mo	75%	9%	9%	7%	.001	Recommended
Jogging on road						
6 wk	4%	13%	81%	1%	.001	Not recommended
6-12 wk	28%	23%	45%	5%	.001	Not recommended
12 wk to 6 mo	63%	11%	21%	5%	.01	Recommended
6 mo	69%	9%	15%	7%	.001	Recommended
Running						
6 wk	3%	9%	86%	3%	.001	Not recommended
6-12 wk	21%	19%	55%	5%	.35	Undecided
12 wk to 6 mo	51%	17%	26%	5%	.27	Undecided
6 mo	61%	12%	21%	7%	.02	Recommended
Running on a treadmill						
6 wk	7%	17%	73%	3%	.001	Not recommended
6-12 wk	30%	23%	42%	5%	.01	Not recommended
12 wk to 6 mo	60%	15%	19%	6%	.01	Recommended
6 mo	67%	11%	13%	8%	.001	Recommended
Mountain biking/incline cycling						
6 wk	7%	9%	80%	5%	.001	Not recommended
6-12 wk	19%	26%	51%	5%	.03	Not recommended
12 wk to 6 mo	45%	28%	20%	7%	.03	Recommended
6 mo	58%	22%	11%	9%	.001	Recommended
Cycling on even ground						
6 wk	28%	25%	43%	4%	.01	Not recommended
6-12 wk	55%	21%	21%	3%	.001	Recommended
12 wk to 6 mo	73%	17%	4%	6%	.001	Recommended
6 mo	77%	13%	2%	8%	.001	Recommended
Static cycling						
6 wk	73%	19%	7%	1%	.001	Recommended
6-12 wk	81%	12%	4%	3%	.001	Recommended
12 wk to 6 mo	87%	7%	0%	5%	.001	Recommended
6 mo	87%	3%	1%	8%	.001	Recommended

THAs per year (Fig. 2). Of the participants, 98% classified themselves as specialists in adult hip reconstruction.

Recommendations to return to sport revealed that 92 (61%) participants stated that they perform sports more than twice a week, whereas 58 (39%) claimed to perform sports less than twice a week.

Statistic significant differences were found for several sport activities comparing surgeons with a high activity level with surgeons with a lower activity level. Participants with a higher activity level allowed following sport activities in the first 6 weeks after THA: tennis singles, basketball, and full contact sports ( $P > .05$ ). Six weeks to 12 weeks after surgery, surgeons with a higher activity level recommended walking, walking stairs, running, aqua fitness, climbing, canyoning, mountain biking and incline cycling, cycling on even ground, static cycling, hiking, Nordic walking, tobogganing, windsurfing, sailing, rowing, canoeing, kayaking, tennis—doubles, tennis—singles, squash, badminton, table tennis, handball, volleyball, soccer and football, basketball, yoga, martial arts, fitness and weight lifting, cross-training, extreme sports ( $P > .05$ ); 12 weeks to 6 months after surgery, handball and basketball ( $P > .05$ ) were recommended, whereas swimming was allowed 6 months after THA by surgeons with a higher activity level (Fig. 2).

In terms of the technical aspects of performing THA, the preferred implant fixation choices were uncemented (71.3% of the respondents), hybrid (12.7%), and fully cemented (11.3%). The

favorite bearing choices were ceramic-on-polyethylene (65.8%), ceramic-on-ceramic (16.8%), and metal-on-polyethylene (12.1%). Few participants stated that they use metal-on-metal (0.7%) and dual mobility (4.6%) as their standard bearing.

A head size of 32 mm or smaller was used by 48% ( $n = 72$ ) of surgeons, whereas head size equal to or bigger than 36mm was used by 52% ( $n = 78$ ). Participants using a 36-mm head or larger allowed ( $P > .05$ ) running on a treadmill, canyoning, cycling on even ground, yoga (6 to 12 weeks), tennis—singles, basketball (12 weeks to 6 months), skiing, cross country skiing/Nordic skiing, tobogganing, sailing, rowing, soccer and football, basketball, yoga, full contact sports, fitness and weight lifting, and cross-training (after 6 months) in comparison with participants using smaller head sizes. In contrast, participants using a 32-mm head or smaller allowed ice skating and skating (within 6 weeks) as well as tennis—doubles (6 to 12 weeks).

The posterior approach was used by 40.3% ( $N = 60$ ) of surgeons, whereas the direct anterior approach was preferred by 20.8% ( $N = 31$ ), the anterolateral approach by 14.1% ( $N = 21$ ), and 24.9% ( $N = 38$ ) performed other surgical approaches for THA.

Participants using the direct anterior approach allowed running, snowboarding, ice skating and skating, tobogganing, (12 weeks to 6 months), as well as snowboarding, handball, soccer and football (6 months) compared with all other approaches ( $P > .05$ ). The following sport activities were allowed for the anterolateral approach: fitness and weight lifting (6 weeks), and for the posterior

**Table 2**  
Summary of Recommendations for Water Sports.

Follow-Up	Allowed	Allowed When Experienced	Not Allowed	No Opinion	z-test P Value	Recommendation
Swimming						
6 wk	50%	31%	19%	1%	.001	Recommended
6-12 wk	77%	18%	3%	2%	.001	Recommended
12 wk to 6 mo	91%	5%	0%	4%	.001	Recommended
6 mo	88%	5%	1%	7%	.001	Recommended
Aqua fitness						
6 wk	53%	22%	21%	5%	.01	Recommended
6-12 wk	74%	19%	4%	3%	.001	Recommended
12 wk to 6 mo	88%	7%	1%	5%	.001	Recommended
6 mo	87%	5%	1%	7%	.001	Recommended
Surfing						
6 wk	3%	7%	82%	7%	.001	Not recommended
6-12 wk	13%	20%	59%	9%	.44	Undecided
12 wk to 6 mo	33%	27%	31%	9%	.27	Undecided
6 mo	45%	29%	17%	9%	.02	Recommended
Windsurfing						
6 wk	3%	8%	82%	7%	.001	Not recommended
6-12 wk	12%	23%	55%	10%	.8	Undecided
12 wk to 6 mo	34%	29%	29%	8%	.55	Undecided
6 mo	49%	26%	15%	10%	.01	Recommended
Sailing						
6 wk	13%	21%	62%	3%	.8	Undecided
6-12 wk	34%	29%	31%	7%	.8	Undecided
12 wk to 6 mo	60%	29%	5%	6%	.001	Recommended
6 mo	74%	15%	3%	9%	.001	Recommended
Rowing						
6 wk	10%	14%	69%	7%	.001	Not recommended
6-12 wk	29%	27%	35%	8%	.07	Undecided
12 wk to 6 mo	56%	25%	11%	7%	.001	Recommended
6 mo	67%	18%	5%	10%	.001	Recommended
Canoeing						
6 wk	9%	11%	73%	7%	.001	Not recommended
6-12 wk	22%	25%	45%	8%	.01	Not recommended
12 wk to 6 mo	49%	30%	15%	7%	.001	Recommended
6 mo	63%	21%	8%	9%	.001	Recommended
Kayaking						
6 wk	7%	12%	75%	6%	.001	Not recommended
6-12 wk	25%	21%	47%	7%	.01	Not recommended
12 wk to 6 mo	48%	30%	15%	7%	.001	Not recommended
6 mo	62%	23%	7%	9%	.001	Recommended

**Table 3**  
Summary of Recommendations for Mountaineering Activities.

Follow-Up	Allowed	Allowed When Experienced	Not Allowed	No Opinion	z-test P Value	Recommendation
<b>Hiking</b>						
6 wk	17%	22%	55%	7%	.55	Undecided
6-12 wk	44%	24%	27%	5%	.35	Undecided
12 wk to 6 mo	62%	23%	6%	9%	.001	Recommended
6 mo	71%	13%	5%	11%	.001	Recommended
<b>Nordic walking</b>						
6 wk	22%	29%	38%	11%	.001	Not recommended
6-12 wk	56%	17%	17%	10%	.02	Recommended
12 wk to 6 mo	73%	12%	5%	9%	.001	Recommended
6 mo	75%	9%	3%	12%	.001	Recommended
<b>Climbing</b>						
6 wk	5%	9%	83%	4%	.001	Not recommended
6-12 wk	16%	26%	53%	5%	.15	Undecided
12 wk to 6 mo	41%	32%	21%	6%	.03	Recommended
6 mo	52%	26%	15%	7%	.001	Recommended
<b>Canyoning</b>						
6 wk	7%	7%	82%	5%	.001	Not recommended
6-12 wk	21%	17%	55%	7%	.67	Undecided
12 wk to 6 mo	37%	27%	28%	9%	.93	Undecided
6 mo	53%	21%	14%	11%	.01	Recommended

approach, bowling (6 weeks) and golf (6-12 weeks) in comparison with all other approaches ( $P > .05$ ). All other approaches showed a statistically higher allowance rate for climbing (6 weeks) and running and dancing (after 6 months).

A total of 58.5% stated that they would allow their patients to drive a car in the first 6 weeks after surgery, 33.3% of the participants six to 12 weeks after surgery, 6.8% if the patient can walk without crutches, and 1.4% of respondents would allow driving 12 weeks to 6 months after primary THA. Recommendations regarding physical therapy were home-based in 43.3%, outpatient in 42.7%, inpatient in 3.3%, and no physical therapy at all in 10.7%. With regard to the length of physical therapy, 38.7% stated that one month and 39.9% stated that longer than one month would be their advice. Of the respondents, 21.3% replied that patients should be individualized in accordance with patient age, comorbidities, and activity level.

Further details are provided in Tables 1-8 and visualized in Figure 3. In the first 6 weeks after THA, walking, walking stairs, static cycling, swimming, and aqua fitness were recommended. Six weeks after THA, cycling on even ground, Nordic walking, golf, yoga, and dancing were recommended in addition to the activities mentioned previously. Further sports activities were recommended 12 weeks after THA surgery: jogging, jogging on road, running on a treadmill, mountain biking and incline cycling, sailing, rowing, canoeing, hiking, climbing, tennis doubles, table tennis, tai-chi, fitness and weight lifting, aerobics, horseback riding, and bowling. The following activities were recommended in addition to the already allowed activities after 6 months of THA surgery: running, surfing, windsurfing, kayaking, canyoning, skiing, cross-country skiing and Nordic skiing, ice skating, tennis singles, badminton, and cross-training. Handball, soccer and football, basketball, full contact sports (eg, boxing), and martial arts were

**Table 4**  
Summary of Recommendations for Winter Sports.

Follow-Up	Allowed	Allowed When Experienced	Not Allowed	No Opinion	z-test P Value	Recommendation
<b>Skiing</b>						
6 wk	3%	7%	85%	4%	.001	Not recommended
6-12 wk	16%	28%	51%	5%	.05	Undecided
12 wk to 6 mo	43%	29%	23%	6%	.07	Undecided
6 mo	57%	25%	10%	9%	.001	Recommended
<b>Cross-country skiing/Nordic skiing</b>						
6 wk	7%	9%	77%	7%	.001	Not recommended
6-12 wk	19%	24%	51%	6%	.11	Undecided
12 wk to 6 mo	43%	26%	23%	9%	.27	Undecided
6 mo	58%	24%	7%	11%	.001	Recommended
<b>Snowboarding</b>						
6 wk	3%	5%	88%	4%	.001	Not recommended
6-12 wk	11%	17%	65%	6%	.07	Undecided
12 wk to 6 mo	29%	24%	39%	9%	.01	Not recommended
6 mo	40%	27%	23%	9%	.44	Undecided
<b>Ice skating/skating</b>						
6 wk	3%	5%	87%	5%	.001	Not recommended
6-12 wk	13%	23%	57%	7%	.001	Not recommended
12 wk to 6 mo	34%	26%	30%	10%	.35	Undecided
6 mo	47%	28%	15%	10%	.01	Recommended
<b>Tobogganing</b>						
6 wk	3%	6%	76%	15%	.001	Not recommended
6-12 wk	14%	19%	53%	14%	.44	Undecided
12 wk to 6 mo	32%	21%	31%	17%	.001	Not recommended
6 mo	45%	23%	15%	17%	.35	Undecided

**Table 5**  
Summary of Recommendations for Ball Sports.

Follow-Up	Allowed	Allowed When Experienced	Not Allowed	No Opinion	z-test P Value	Recommendation
Tennis—doubles						
6 wk	10%	13%	75%	2%	.001	Not recommended
6–12 wk	33%	29%	34%	5%	0.55	Undecided
12 wk to 6 mo	63%	23%	9%	6%	.001	Recommended
6 mo	78%	11%	5%	7%	.001	Recommended
Tennis—singles						
6 wk	6%	11%	81%	3%	.001	Not recommended
6–12 wk	23%	25%	47%	4%	.001	Not recommended
12 wk to 6 mo	49%	23%	21%	7%	.07	Undecided
6 mo	65%	15%	13%	7%	.001	Recommended
Golf						
6 wk	25%	23%	49%	4%	.01	Not recommended
6–12 wk	51%	29%	15%	5%	.001	Recommended
12 wk to 6 mo	75%	17%	3%	5%	.001	Recommended
6 mo	85%	5%	3%	7%	.001	Recommended
Squash						
6 wk	7%	6%	83%	5%	.001	Not recommended
6–12 wk	19%	20%	56%	5%	.55	Undecided
12 wk to 6 mo	41%	21%	31%	7%	.44	Undecided
6 mo	50%	19%	21%	9%	.2	Undecided
Badminton						
6 wk	7%	11%	75%	7%	.001	Not recommended
6–12 wk	21%	25%	45%	9%	.01	Not recommended
12 wk to 6 mo	45%	23%	21%	10%	.44	Undecided
6 mo	60%	18%	11%	11%	.03	Recommended
Table tennis						
6 wk	18%	16%	61%	5%	.67	Undecided
6–12 wk	37%	29%	29%	5%	.67	Undecided
12 wk to 6 mo	65%	19%	10%	6%	.001	Recommended
6 mo	77%	11%	4%	8%	.001	Recommended
Handball						
6 wk	5%	3%	85%	7%	.001	Not recommended
6–12 wk	13%	19%	62%	7%	.27	Undecided
12 wk to 6 mo	29%	17%	44%	9%	.02	Not recommended
6 mo	36%	19%	34%	11%	.03	Not recommended
Volleyball						
6 wk	5%	3%	86%	6%	.001	Not recommended
6–12 wk	13%	17%	65%	5%	.11	Undecided
12 wk to 6 mo	30%	20%	42%	8%	.001	Not recommended
6 mo	40%	21%	30%	9%	.44	Undecided
Soccer/football						
6 wk	3%	3%	89%	5%	.001	Not recommended
6–12 wk	10%	13%	70%	7%	.001	Not recommended
12 wk to 6 mo	22%	19%	51%	9%	.44	Undecided
6 mo	32%	21%	38%	9%	.01	Not recommended
Basketball						
6 wk	4%	3%	89%	3%	.001	Not recommended
6–12 wk	11%	16%	67%	5%	.03	Not recommended
12 wk to 6 mo	26%	19%	46%	9%	.07	Undecided
6 mo	35%	21%	35%	9%	.03	Not recommended

not recommended after 6 months. No recommendation could be given for snowboarding, tobogganing, squash, volleyball, and extreme sports as they did not reach statistical significance ( $P > .05$ ) after 6 months. Snowboarding, tobogganing, volleyball, and extreme sports were not recommended within 6 months, whereas squash was not recommended until six weeks of surgery. Out of 47 listed activities, 37 were allowed 6 months after primary THA.

As the greatest risk resulting from physical activity for patients who underwent THA, dislocation (37.3%,  $n = 56$ ), periprosthetic fracture (20.7%,  $n = 31$ ), polyethylene wear (20%,  $n = 30$ ), and aseptic loosening (15.3%,  $n = 23$ ) were mentioned. Furthermore, 6.7% ( $n = 10$ ) stated that it is associated with the type of sport activity.

## Discussion

For public health, maintenance of successful aging is very important, with a significant emphasis on being as physically active

as possible in older age [14]. Insufficient physical activity is a risk factor for mortality [15]. Recent published data on large samples of hundreds of thousands individuals in the United States of America, Sweden, and China have demonstrated significant benefits of physical exercise [16]. Even 15 minutes of daily moderate-intensity exercise produces a gain of 2.5 years of life expectancy as compared with sedentary individuals. All-cause mortality risks are reduced by 16% for active hypertensive or dyslipidemic individuals as compared with inactive individuals and by 22% for the subgroup of diabetic or prediabetic patients. These data emphasize the great benefit of 2 hours of weekly physical exercise with an impact of reducing the risk of mortality [16,17]. More and more individuals are now seeking joint arthroplasty to maintain an active lifestyle or restore the ability to participate in physical activities [18]. Sports continue to play an important role in the older age group and increase social interaction for patients who underwent THA. On the other side, young patients, in particular, may seek their surgeon's approval for performing even extreme sports. Although satisfaction of the patient's expectations is

**Table 6**  
Summary of Recommendations for Contact Sports.

Follow-Up	Allowed	Allowed When Experienced	Not Allowed	No Opinion	z-test P Value	Recommendation
Tai chi						
6 wk	24%	23%	41%	11%	.01	Not recommended
6-12 wk	39%	29%	23%	9%	.44	Undecided
12 wk to 6 mo	60%	17%	11%	11%	.001	Recommended
6 mo	71%	11%	6%	13%	.001	Recommended
Full contact sports (eg, boxing)						
6 wk	3%	3%	90%	3%	.001	Not recommended
6-12 wk	11%	5%	79%	5%	.001	Not recommended
12 wk to 6 mo	18%	17%	57%	8%	.8	Undecided
6 mo	29%	17%	45%	9%	.01	Not recommended
Martial arts						
6 wk	3%	6%	84%	7%	.001	Not recommended
6-12 wk	9%	13%	71%	7%	.001	Not recommended
12 wk to 6 mo	19%	21%	49%	10%	.27	Undecided
6 mo	30%	20%	39%	11%	.001	Not recommended

of paramount importance for a successful outcome [19], wise and balanced suggestions are necessary to avoid undesirable complications [5]. Surgeons participating in the survey mentioned total hip dislocation (37.3%) followed by periprosthetic fracture (20.7%) and polyethylene wear (20%) as the greatest risks resulting from sports activity after THA. For these reasons, the knowledge of the up-to-date information and advices provided by hip surgeons to their patients after THA is extremely worthwhile.

Participants who were performing sports on a high activity level (more than twice a week) allowed patients sooner to return to sports activities for most sport activities (33 out of 47) evaluated in this study. This might lead to the assumption that individuals who frequently perform sports and have routine in performing sports may have tendency to allow more sport activities.

Participants who use head sizes larger than or equal to 36mm allowed patients to return to their sports activities sooner in winter sports, water sports as well as team sports like handball or basketball. Assuming that a larger femoral head reduces dislocations after THA, the use of large femoral heads increases the number of sport activities which are allowed after THA.

Participants who used the direct anterior approach for THA allowed demanding sport activities such as, for example, snowboarding, handballs, soccer and football compared with other

approaches (8 out of 47 approaches). Surgeons who preferred the anterolateral approach as well as the posterior approach allowed only in 2 sport activities compared with all other approaches. Although the number of surgeons who completed the current survey is too small to provide a general statement, a tendency was found that the use of direct anterior approach for THA might lead to more sport activities which are allowed after THA.

The results of this study represent the current recommendations made by members of the EHS for patients who underwent primary THA. The EHS is the only hip society in Europe, and approximately 30% of its full members are professors. Therefore, the members can be considered to be experts in the field of THA.

A unique feature of the current survey was the fact that it also addressed predefined time periods after implantation of a primary THA. Subdividing the time periods into immediately after surgery (6 weeks), 6 weeks to 12 weeks after surgery, 12 weeks to 6 months after surgery, and after 6 months after surgery will lead to a more detailed recommendation for an increasingly active aging patient population. In addition, the guidelines used by most surgeons for many activities had changed since the reports made by Healy in 1999 (HS Survey) [12] and Klein's publication in 2007 [8] (HS and AAHKS). Klein in 2007 investigating 30 physical activities presented a greater tolerance and acceptance by the surveyed

**Table 7**  
Summary of Recommendations for Fitness Training.

Follow-Up	Allowed	Allowed When Experienced	Not Allowed	No Opinion	z-test P Value	Recommendation
Fitness/weight lifting						
6 wk	18%	15%	61%	5%	.55	Undecided
6-12 wk	39%	27%	31%	3%	.67	Undecided
12 wk to 6 mo	64%	21%	9%	7%	.001	Recommended
6 mo	74%	10%	7%	9%	.001	Recommended
Cross-training						
6 wk	12%	8%	73%	7%	.001	Not recommended
6-12 wk	29%	23%	41%	7%	.001	Not recommended
12 wk to 6 mo	47%	22%	19%	12%	.2	Undecided
6 mo	58%	17%	13%	13%	.01	Recommended
Yoga						
6 wk	15%	25%	55%	5%	.35	Undecided
6-12 wk	39%	34%	23%	4%	.02	Recommended
12 wk to 6 mo	65%	21%	8%	6%	.001	Recommended
6 mo	74%	14%	3%	9%	.001	Recommended
Aerobics						
6 wk	11%	18%	65%	5%	.001	Not recommended
6-12 wk	39%	31%	25%	5%	.2	Undecided
12 wk to 6 mo	67%	22%	6%	5%	.001	Recommended
6 mo	75%	13%	3%	9%	.001	Recommended

**Table 8**  
Summary of Recommendations for Miscellaneous Physical Activities.

Follow-Up	Allowed	Allowed When Experienced	Not Allowed	No Opinion	z-test P Value	Recommendation
<b>Horseback riding</b>						
6 wk	7%	16%	71%	6%	.001	Not recommended
6–12 wk	21%	37%	37%	5%	.15	Undecided
12 wk to 6 mo	45%	35%	13%	7%	0.001	Recommended
6 mo	61%	25%	6%	8%	.001	Recommended
<b>Extreme sports</b>						
6 wk	2%	1%	93%	4%	.001	Not recommended
6–12 wk	7%	7%	78%	8%	.001	Not recommended
12 wk to 6 mo	18%	9%	63%	10%	.03	Not recommended
6 mo	25%	10%	52%	13%	.93	Undecided
<b>Dancing</b>						
6 wk	17%	31%	49%	3%	.001	Not recommended
6–12 wk	52%	29%	17%	3%	.001	Recommended
12 wk to 6 mo	78%	13%	4%	5%	.001	Recommended
6 mo	84%	7%	1%	7%	.001	Recommended
<b>Bowling</b>						
6 wk	18%	16%	63%	3%	.001	Not recommended
6–12 wk	48%	22%	27%	3%	.15	Undecided
12 wk to 6 mo	69%	16%	8%	7%	.001	Recommended
6 mo	78%	8%	5%	9%	.001	Recommended

surgeons in granting their patients the ability to return to many activities that were not allowed in 1999 [8]. Klein reported that 10 years after the last survey, some activities were allowed or allowed with experience that previously were not included (eg, dancing, rowing, downhill skiing, weightlifting) [8]. Activities that in 1999 had been allowed with experience such as hiking, bowling, road cycling, and low-impact aerobics were reclassified as allowed [8]. Our findings also demonstrate a trend toward greater acceptance and tolerance of several sports activities. We subdivided running and jogging (jogging is defined as going at a pace of less than 6 miles per hour) into running, running on a treadmill, jogging on road, and jogging on a treadmill. Although Klein's results discourage jogging [8], singles tennis, and difficult skiing, our survey revealed the recommendation to start with running on a treadmill, jogging on road, and jogging 12 weeks after THA. Running was allowed 6 months after surgery.

The results of the current survey show that skiing, ice skating and skating, cross-country skiing and Nordic skiing, that were not recommended previously, are now allowed 6 months after surgery by most EHS members (82%, 75%, and 82%, respectively). Snowboarding and tobogganing are the only activities that showed inconclusive data. Therefore, the recommendation to start snowboarding and tobogganing 6 weeks after surgery cannot be made. Twenty-three percent of surgeons do not allow snowboarding and 15% do not allow tobogganing after 6 months. In contrast to Klein's results [8], singles tennis was recommended 6 months after surgery with only 13% of participants objecting. Klein's results also discourage patients from performing aerobics [8]. In contrast to these findings, our results demonstrate that aerobics is recommended 12 weeks to 6 months after surgery by 89% of surgeons.

Our study results show that a patient's experience in a physical activity did not strongly influence the surgeons' recommendations. Another finding of the current data is that time after surgery plays an important role in the recommendation for returning to a sport after THA. At 6 weeks after THA, only 5 of 47 sports activities (11%) were recommended. At 12 weeks, 10 of 47 activities (21%), at 12 weeks to 6 months, 26 of 47 activities (55%), and after 6 months, 37 of 47 activities (79%) were recommended. This represents the clear trend toward allowing more sports activities when the patient has gained more experience with the joint arthroplasty. The chronological sequence after THA for recommendations for resuming physical activities seems to play an important role for surgeons.

Klein only gave a general recommendation regarding the time interval for returning to physical activities. A total of 60.4% of the AAHKS surgeons and 71% of the HS surgeons recommended waiting 3 months after surgery before starting sports activities. In our survey, the only activities that clearly were not recommended even 6 months after primary THA were full contact sports (eg, boxing), handball, soccer and football, basketball, and martial arts.

The publication by Bradley (BHS) focuses on younger, more active patients, and the survey was conducted aimed at young adult hip specialists in a regional area (UK) [11]. Therefore, Bradley's recommendations for returning to a sports activity after THA cannot be used as a general recommendation for all patients after THA. His results discourage high-impact sports (eg, jogging, martial arts, and squash) except cricket. Martial arts and squash were also not recommended or undecided recommendation in our survey, but in contrast to his findings, we found that all kinds of running were recommended 12 weeks to 6 months after surgery and jogging after 6 months after surgery by most surgeons. Only 21% of the surgeons did not allow running after 6 months. It is well known that between the United Kingdom and continental Europe, there are also regional differences in physical activities [20], surgical techniques [11,13], preferred approaches, head sizes, preferred implant choices, and bearing surfaces. The majority of the participants in the BHS survey preferred posterior approaches (78.6%) [11], whereas our survey showed that 48.4% preferred a posterior approach, 20.8% an anterior approach, and 14.1% an anterolateral approach for primary THA. Ceramic-on-polyethylene (65.8%) was the preferred bearing surface in the current survey, whereas the BHS survey showed the preferred use of ceramic-on-ceramic (39.8%) in athletic patients. However, we did not specify the recommendations for young active patients, and therefore, these comparisons are of limited value. Nevertheless, the increased use of muscle-sparing approaches (anterior approach, anterolateral approach, mini-posterior approach), the routine use of larger ( $\geq 36$  mm) head sizes, encountered in the current survey in Europe might favor to extend the recommendations for resumption of sports after THA in comparison with the BHS survey. Bradley did not recommend performing weight lifting or high-impact aerobics even in young patients, whereas both activities were recommended 12 weeks after THA in the present study by 75% and 89% of the surgeons, respectively. These





Fig. 3. Summary of recommendations to return to physical activity after different time periods.

findings in the current survey are new because so-called high-impact sports activities were not recommended at all after THA in the past. The current results emphasize that patients are allowed to perform road jogging (78% of responders), cross-training (75%), and aerobics (88%) 6 months after THA, indicating a clear trend to reducing sports limitations after THA.

The present survey also analyzed sports activity performed by orthopedic surgeons themselves. Ninety-two (61.7%) of them do perform sports at least twice a week, indicating a physically active community of surgeons. This attitude can also explain the reduction of the restrictions to sports activity for patients who underwent THA by the European surgeons.

Limitations of our study include the relatively small number of responders (30.6%). Nevertheless, this is the largest survey on this topic at a European level and the most recent one. Other limitations of this study are related to the fact that it was an Internet-based survey. We cannot hope to get every hip surgeon

involved, but the responders were members of the EHS and can therefore be considered to be among the hip specialists and opinion leaders in Europe. There seems to be no reason to suspect that the sample we analyzed is not representative for the EHS. Like most recommendations for resuming sports after THA, our findings are not based on strong scientific evidence but rather on clinical practice [18]. However, the aim of the study was to investigate the up-to-date recommendations given by arthroplasty surgeons to their patients.

In conclusion, this is the first report describing the recommendations of European hip arthroplasty surgeons on resuming physical activity in a large number of sports after THA. Patients were allowed to restart activity at different time periods after surgery in accordance with the type of sport. Most physical activities were allowed 6 months after THA. The experience of the patient in performing a distinct physical activity did not influence the recommendations to return to sports. European surgeons are

progressively mitigating restrictions to sports after THA. Further studies should evaluate the effects of these trends on patients' outcome and implant survival.

## References

- [1] Pivec R, Johnson AJ, Mears SC, Mont MA. Hip arthroplasty. *Lancet* (London, England) 2012;380:1768–77. [https://doi.org/10.1016/S0140-6736\(12\)60607-2](https://doi.org/10.1016/S0140-6736(12)60607-2).
- [2] Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR). Hip, Knee & Shoulder Arthroplasty: 2019 Annual Report. Adelaide. AOA; 2019. <https://aoanjrr.sahmri.com/annual-reports> [accessed 25.05.2020].
- [3] Takeuchi K, Hashimoto S, Matsumoto T, Hayashi S, Takayama K, Kuroda R. Recovery of activity level following total hip arthroplasty in patients less than 60 years of age. *Hip Int* 2020. <https://doi.org/10.1177/1120700020911911>. 1120700020911911.
- [4] Ibrahim SA. Racial and ethnic disparities in hip and knee joint replacement: a review of research in the Veterans Affairs Health Care System. *J Am Acad Orthop Surg* 2007;15(Suppl 1):S87–94. <https://doi.org/10.5435/00124635-200700001-00019>.
- [5] Zagra L. Advances in hip arthroplasty surgery: what is justified? *EFORT Open Rev* 2017;2:171–8. <https://doi.org/10.1302/2058-5241.2.170008>.
- [6] Stenner BJ, Mosewich AD, Buckley JD. Why do older adults play golf? An evaluation of factors related to golf participation by older adults. *J Aging Phys Act* 2019;1–7. <https://doi.org/10.1123/japa.2018-0448>.
- [7] Australian Institute for Health and Welfare. *Australia's health 2018. Australia's health series no. 16. AUS 221*. Canberra: AIHW; 2018.
- [8] Klein GR, Levine BR, Hozack WJ, Strauss EJ, D'Antonio JA, Macaulay W, et al. Return to athletic activity after total hip arthroplasty. Consensus guidelines based on a survey of the Hip Society and American Association of Hip and Knee Surgeons. *J Arthroplasty* 2007;22:171–5. <https://doi.org/10.1016/j.arth.2006.09.001>.
- [9] Patel NN, Shah JA, Erens GA. Current trends in clinical practice for the direct anterior approach total hip arthroplasty. *J Arthroplasty* 2019;34:1987–1993.e3. <https://doi.org/10.1016/j.arth.2019.04.025>.
- [10] Taunton MJ, Trousdale RT, Sierra RJ, Kaufman K, Pagnano MW. John Charnley Award: Randomized clinical trial of direct anterior and Miniposterior approach THA: which provides better functional recovery? *Clin Orthop Relat Res* 2018;476:216–29. <https://doi.org/10.1007/s11999-000000000000112>.
- [11] Bradley BM, Moul SJ, Doyle FJ, Wilson MJ. Return to sporting activity after total hip arthroplasty-A survey of members of the British hip society. *J Arthroplasty* 2017;32:898–902. <https://doi.org/10.1016/j.arth.2016.09.019>.
- [12] Healy WL, Iorio R, Lemos MJ. Athletic activity after joint replacement. *Am J Sports Med* 2001;29:377–88. <https://doi.org/10.1177/03635465010290032301>.
- [13] Varnum C, Pedersen AB, Rolfson O, Rogmark C, Furnes O, Hallan G, et al. Impact of hip arthroplasty registers on orthopaedic practice and perspectives for the future. *EFORT Open Rev* 2019;4:368–76. <https://doi.org/10.1302/2058-5241.4.180091>.
- [14] WHO. *Global action plan on physical activity 2018–2030: more active people for a healthier world*. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO. n.d.
- [15] WHO. WHO. WHO | Prevalence of insufficient physical activity [Internet]. WHO. [http://www.who.int/gho/ncd/risk\\_factors/physical\\_activity\\_text/en/index.html#](http://www.who.int/gho/ncd/risk_factors/physical_activity_text/en/index.html#); 2012 [accessed 29.11.2012].
- [16] Moore SC, Patel AV, Matthews CE, Berrington de Gonzalez A, Park Y, Katki HA, et al. Leisure time physical activity of moderate to vigorous intensity and mortality: a large pooled cohort analysis. *PLoS Med* 2012;9:e1001335. <https://doi.org/10.1371/journal.pmed.1001335>.
- [17] Wen CP, Wai JPM, Tsai MK, Yang YC, Cheng TYD, Lee M-C, et al. Minimum amount of physical activity for reduced mortality and extended life expectancy: a prospective cohort study. *Lancet* (London, England) 2011;378:1244–53. [https://doi.org/10.1016/S0140-6736\(11\)60749-6](https://doi.org/10.1016/S0140-6736(11)60749-6).
- [18] Swanson EA, Schmalzried TP, Dorey FJ. Activity recommendations after total hip and knee arthroplasty: a survey of the American Association for Hip and Knee Surgeons. *J Arthroplasty* 2009;24:120–6. <https://doi.org/10.1016/j.arth.2009.05.014>.
- [19] Anakwe RE, Jenkins PJ, Moran M. Predicting dissatisfaction after total hip arthroplasty: a study of 850 patients. *J Arthroplasty* 2011;26:209–13. <https://doi.org/10.1016/j.arth.2010.03.013>.
- [20] Kwak L, Berrigan D, Van Domelen D, Sjöström M, Hagströmer M. Examining differences in physical activity levels by employment status and/or job activity level: gender-specific comparisons between the United States and Sweden. *J Sci Med Sport* 2016;19:482–7. <https://doi.org/10.1016/j.jsams.2015.05.008>.