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# Sports Activity After Short-Stem Hip Arthroplasty

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*Investigation performed at the University of Munich (LMU), Munich, Germany*

**Background:** No data are available about the sports activity of patients with bone-conserving short-stem hip implants.

**Hypothesis:** Patients can return to a good level of sports activity after implantation of a short-stem hip implant.

**Study Design:** Case series; Level of evidence, 4.

**Methods:** The sports activity level of 68 patients (76 hips) after short-stem hip arthroplasty was assessed for a minimum of 2 years after implantation. In addition to the clinical examination, a detailed evaluation of the patients' sports pattern was obtained. Furthermore, the results were analyzed with regard to gender (female and male) and age ($\leq$55 and $>$55 years).

**Results:** After a mean of 2.7 years, patients showed a Harris Hip Score (HHS) of 93.6, a Western Ontario and McMaster Universities Arthritis Index (WOMAC) score of 9.5, and a University of California, Los Angeles (UCLA) activity score of 7.6, with each individual participating on average in 3.5 different disciplines after surgery compared with 3.9 before surgery. High-impact activities decreased significantly postoperatively, whereas low-impact activities increased significantly. The duration of the sports activities remained stable, while the frequency actually increased. In contrast, men participated preoperatively in more sports than women (4.3 men vs 3.3 women). However, because of a pronounced decrease in high-impact activities by men, both genders participated in an equal number of sports postoperatively (3.5 men vs 3.5 women). Finally, 45% (n = 31) reported at least one activity that they missed. Most of them were disciplines with an intermediate- or high-impact level.

**Conclusion:** Patients with a short-stem hip implant can return to a good level of activity postoperatively. Participation in sports almost reached similar levels as preoperatively but with a shift from high- to low-impact activities. This seems desirable from a surgeon's point of view but should also be communicated to the patient before hip replacement.

**Keywords:** hip arthroplasty; short stem; sports; activity; young patients

The number of total hip replacements being performed is increasing rapidly because of the excellent outcomes associated with the procedure. At the same time, expectations have steadily increased. Patients often request hip arthroplasty not only for pain relief but also to maintain a high level of activity to participate in social and sporting events.[10] And although it is not recommended, quite a few patients return to high-impact sports such as jogging or tennis, underscoring their desire for sports activities.[2,23] However, higher activity is assumed to increase the risk of early implant failure, as seen in young patients who exhibit higher loosening rates sooner than older patients.[29] To facilitate revision surgeries, bone-conserving implants, like those used in hip-resurfacing arthroplasty (HRA) and short-stem hip arthroplasty (SHA), have been developed.

Until now, resurfacing and short-stem implants have shown good midterm results,[4,13,21,30] but patients increasingly inquire about the feasible activity level with those implants. Although several studies have evaluated sports activity levels after hip arthroplasty, only a few have given a detailed analysis, especially with regard to the preoperative and postoperative level, frequency, number, and kinds of sports.[2,11,15,16,20,23] Furthermore, most of the recent studies have mainly focused on HRA and only to a small extent on standard total hip arthroplasty (THA).[2,23,24] Although SHA is increasingly used, there are no data available about sports activity levels. Therefore, the aim of this study was to provide comprehensive data about sports activity levels and the subjective outcome of patients with a short-stem hip implant.

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## MATERIALS AND METHODS

### Patients

This retrospective study included the first consecutive patients (n = 92) who received SHA between May 2006 and November 2008 at our clinic (minimum follow-up, 24 months). The inclusion criteria for SHA were age <65 years, sufficient bone stock, and no severe varus (head-neck-shaft [CCD] angle >120°) or anatomic deformities of the femoral neck. Patients with a higher age were only included if they specifically requested the procedure and had no osteoporosis.

From the collective, patients were excluded if they were not able to complete the questionnaire (n = 1) or if they were living abroad (n = 5). Further excluded were patients with contralateral hip resurfacing (n = 1), organ transplantation (n = 1), cancer (n = 1), spinal stenosis (n = 2), and disc herniation (n = 2), leaving a study collective of 79 patients. The study protocol was approved by the Ethics Committee of our university, and all patients were informed in detail about the study and signed an informed consent form.

### Implant and Surgical Technique

All patients received the same short-stem implant (Metha, BBraun Aesculap, Tuttlingen, Germany) (Figure 1). The implant sizes range from 0 to 7 and are available as a monoblock (CCD angle, 130° and 135°) or as a modular implant with cone adapters (CCD angle, 130°, 135°, 140°, and 7.5° anteversion, 7.5° retroversion, neutral). For the acetabular component, either a threaded or a press-fit cup (Screwring or Plasmacup, BBraun Aesculap) was used. Both cups are modular and available with either a polyethylene or a ceramic liner. Surgeries were performed, by 3 senior surgeons (A.F., F.M., V.J.), through a modified minimally invasive Hardinge approach in the supine position.[8] Restrictions were given concerning weightbearing and range of motion only for the first 6 weeks postoperatively. Recommendations for sports activity levels meet the consensus guidelines based on a survey of the Hip Society (HS) and American Association of Hip and Knee Surgeons (AAHKS).[14]

### Study Protocol

Patients were seen in the outpatient clinic of our department for follow-up. Along with a clinical assessment of the hip, a standardized anteroposterior radiograph and a lateral radiograph were obtained to exclude signs of loosening. Migration of the stem was measured as the change in distance between the lateral shoulder of the stem and the tip of the major trochanter between the first and the most recent radiograph.[31] A difference of >2 mm defined subsidence. The acetabular component was considered loose if there was a migration from the vertical teardrop line, a continuous radiolucency, or a change in the inclination angle of >4°.[18]

The Harris Hip Score (HHS) was determined during the patients' last follow-up.[9] Additionally, all patients completed

**Figure 1.** Metaphyseally anchored short-stem hip arthroplasty (Metha, BBraun Aesculap, Tuttlingen, Germany).

the Western Ontario and McMaster Universities Arthritis Index (WOMAC) and specified their activity level according to the University of California, Los Angeles (UCLA) activity score.[3,33]

Patients were asked in detail for their sports activity pattern. They could choose between 22 different sports activities that they participated in both preoperatively and postoperatively. Additionally, they had the possibility to add further disciplines to the list. Preoperative and postoperative activity frequency (<1, 1, 2, 3, and 4 or more per week), duration of their sports activities (0-30, 30-60, 60-90, 90-120, and >120 minutes per session), and how many months it took to return to sports activities (not possible, 1-2, 3-4, and 5-6 months or more) were queried. Patients could rate their postoperative pain on a visual analog scale (VAS) (range, 0-10), with 0 representing no pain and 10 representing severe pain. They were also asked how their ability to participate in sports, their physical fitness, and their range of motion developed after their hip replacement procedure. Insecurity/fear and pain during sports activities were queried as well as their overall satisfaction. Finally, patients were asked if they missed participating in any sporting activity that they had participated in before their hip replacement and the reason for no longer participating in that activity.

TABLE 1
Clinical Scores of Patients With a Short-Stem Implant[a]

| Assessment Tool | Total | Men | Women | ≤55 Years | >55 Years |
|---|---|---|---|---|---|
| HHS (0-100) | 93.6 ± 6.3 | 94.9 ± 4.2 | 91.8 ± 8.2 | 93.5 ± 5.4 | 93.6 ± 7.0 |
| WOMAC (0-100) | 9.5 ± 10.2 | 7.8 ± 8.2 | 12.1 ± 12.4 | 8.7 ± 10.8 | 10.1 ± 9.8 |
| UCLA activity score (0-10) | 7.6 ± 1.9 | 7.9 ± 1.9 | 7.0 ± 1.9 | 7.2 ± 1.9 | 7.9 ± 1.8 |

[a]Data are presented as mean ± standard deviation. HHS, Harris Hip Score; WOMAC, Western Ontario and McMaster Universities Arthritis Index; UCLA, University of California, Los Angeles.

## Patient and Statistical Analyses

Analysis was performed on the total number of patients recruited. Subgroup analyses were performed based on gender (male and female) and age (≤55 and >55 years). Statistical analyses were performed using SigmaStat 3.1 (Systat Software GmbH, Erkrath, Germany), and graphs were produced using SigmaPlot 8.02 (Systat Software GmbH). Data are given as mean values and standard deviations. The Mann-Whitney *U* test was used to analyze unpaired nonparametric data, and the Wilcoxon signed-rank test was used for the paired nonparametric data. A *P* value <.05 was considered significant.

# RESULTS

## Demographics

From 79 included patients, 68 patients (86.1%) with 76 hip arthroplasties participated, with 5 patients lost during the follow-up because they had moved and could not be contacted. Another 6 patients refused to come to our clinic because of reasons not related to the implant. The time between surgery and the final follow-up was on average 2.7 ± 0.7 years (range, 2.0-4.2 years).

The mean age of the cohort was 55 ± 12 years (range, 20-73 years), with a body mass index (BMI) of 26 ± 4 kg/m$^2$ (range, 18-39 kg/m$^2$). Sixty percent (n = 41) of the group were men, with a mean age of 56 ± 10 years (range, 25-72 years) and a BMI of 27 ± 3 kg/m$^2$ (range, 21-35 kg/m$^2$). Forty percent (n = 27) were women, with a mean age of 54 ± 14 years (range, 20-71 years) and a BMI of 24 ± 5 kg/m$^2$ (range, 18-39 kg/m$^2$). The age subgroups were defined as ≤55 years and >55 years. The younger group consisted of 30 patients (44%), with a mean age of 45 ± 9 years (range, 20-55 years) and a BMI of 26 ± 5 kg/m$^2$ (range, 18-39 kg/m$^2$). The older patient group consisted of 38 patients (56%), with a mean age of 64 ± 5 years (range, 56-72 years) and a BMI of 26 ± 4 kg/m$^2$ (range, 18-34 kg/m$^2$).

Reasons for hip replacement were osteoarthritis (n = 32), dysplasia (n = 23), avascular necrosis (n = 17), trauma (n = 1), and self-limited juvenile rheumatoid arthritis (n = 3). From the 17 hips with avascular necrosis, 6% (n = 1) were stage 3, and 94% (n = 16) were stage 4, according to the Association Research Circulation Osseous (ARCO) classification.[19] According to the Crowe classification for dysplastic hips (n = 23), 65% (n = 15) were type I, 22% (n = 5) type II, 9% (n = 2) type III, and 4% (n = 1) type IV.[6] Using the Kellgren and Lawrence classification for the remaining hips (n = 36), 11% (n = 4) had grade II, 58% (n = 21) had grade III, and 31% (n = 11) had grade IV osteoarthritis.[12]

## Implant

The average stem size was 2.7 ± 1.5 (range, 0-6), with a CCD angle of 130° in 43% (n = 33), 135° in 54% (n = 41), and 140° in 3% (n = 2) of the implants. A ceramic head was used in all patients, with a diameter of 28 mm in 11% (n = 8), 32 mm in 68% (n = 52), and 36 mm in 21% (n = 16) of the implants. A short head was used in 32% (n = 24), a medium in 46% (n = 35), a large in 20% (n = 15), and an extra large in 3% (n = 2) of the implants. The average acetabular cup size was 51.3 ± 3.5 mm (range, 44-58 mm), with a ceramic liner in 34% (n = 26) and a polyethylene liner in 66% (n = 50) of the implants.

## Radiological Results

After 2 years, no implant had failed, and 98.7% (n = 75) showed good stability, with 3.9% (n = 3) showing an initial subsidence (4-5 mm) only within the first 2 months. One stem (1.3%) showed a progressive subsidence to about 1 cm over 32 months, but the patient was clinically asymptomatic (HHS, 97; WOMAC, 0; UCLA, 6). None of the cementless cups showed signs of loosening.

## Clinical Results

The mean HHS as determined during the last follow-up was 93.6 ± 6.3 (range, 71-100). Ninety-six percent (n = 65) of the patients had a good or excellent HHS, and 4% (n = 3) obtained a fair HHS. The mean postoperative WOMAC score was 9.5 ± 10.2 (range, 0-43), with 1.5 ± 2.1 for the pain category, 1.5 ± 1.5 for the stiffness category, and 6.5 ± 7.5 for the function category. The mean UCLA activity score was 7.6 ± 1.9 (range, 3-10). The specific values of the subgroups are shown in Table 1. There was no significant difference in the above scores when a subgroup analysis was applied with regard to gender and age (HHS, *P* = .566; WOMAC, *P* = .549; UCLA, *P* = .148). Women had slightly lower scores than men, however, with no significant difference (HHS, *P* = .338; WOMAC, *P* = .203; UCLA, *P* = .063).

## Sports Activity

Of the 62 patients who were still playing sports up until surgery, 98% could return to sports activities after surgery. One patient had to give up his sports activities because of diffuse back pain, whereas one patient could restart sports because of an improved function of the hip. Twenty-six percent (n = 18) were able to return to sports after 1 to 2 months, 25% (n = 17) after 3 to 4 months, and 47% (n = 32) after 5 to 6 or more months. Men and younger patients returned to sports activities slightly faster than women and older patients, with the difference not being significant (men vs women, $P = .175$; ≤55 vs >55 years, $P = .595$) (Figure 2C).

Preoperatively, patients were engaged in an average of 3.9 ± 2.4 sports disciplines, with a slight decrease to 3.5 ± 2.0 postoperatively ($P = .101$) (Figure 3A). After surgery, 41% performed a lower number of disciplines, and 59% performed an equal or increased number of disciplines. Men were preoperatively engaged in 4.3 ± 2.6 disciplines, with a significant decrease to 3.5 ± 1.9 disciplines postoperatively ($P = .009$). In contrast, women performed 3.3 ± 2.0 activities preoperatively, which increased slightly to 3.5 ± 2.2 activities postoperatively ($P = .479$). For the age-specific comparison, the older patient group participated on both occasions in a higher number of activities than the younger patient group (preoperative, 3.6 ± 2.7 vs 3.2 ± 2.3 [$P = .354$]; postoperative, 4.2 ± 2.2 vs 3.8 ± 1.7 [$P = .361$]) (Figure 3A).

In regard to the intensity of the activities, the biggest shift was seen for the intermediate- and high-impact sports, which both decreased significantly after surgery ($P = .001$ and $P = .001$, respectively). As men performed more high-impact activities preoperatively, this shift was predominantly observed in men ($P = .001$) and to a lesser extent in women ($P = .750$). At the same time, low-impact activities increased significantly after surgery ($P = .033$) (Figure 3 and Table 2).

The weekly sports activity of the cohort as a whole increased significantly after surgery from a mean of 1.5 ± 0.9 to 1.8 ± 1.1 ($P = .022$). The older patient group showed a significant increase from 1.4 ± 0.8 to 1.7 ± 0.9 ($P = .018$) sessions per week, while the younger group went from 1.6 ± 1.1 to 1.9 ± 1.3 ($P = .296$) sessions per week, which was, however, not significant (Figure 2A). Similarly, both gender groups showed a higher rate of sports activity postoperatively, with an increase from 1.5 ± 0.9 to 1.9 ± 1.2 ($P = .110$) sessions per week for women and from 1.5 ± 1.0 to 1.7 ± 1.1 ($P = .142$) sessions per week for men.

The mean session length of the whole cohort did not increase significantly after surgery (67 ± 35 minutes to 66 ± 33 minutes; $P = .753$) (Figure 2B). The mean session length tended to increase in the older group from 74 ± 29 minutes to 82 ± 28 minutes ($P = .094$), whereas in the younger group, the session length tended to decrease from 58 ± 39 minutes to 51 ± 29 minutes ($P = .359$). In contrast, both genders showed a similar duration in their session length and no difference from preoperative to postoperative duration (men, 69 ± 32 minutes to 66 ± 30 minutes [$P = .685$]; women, 64 ± 38 minutes to 65 ± 34 minutes [$P = .978$]).

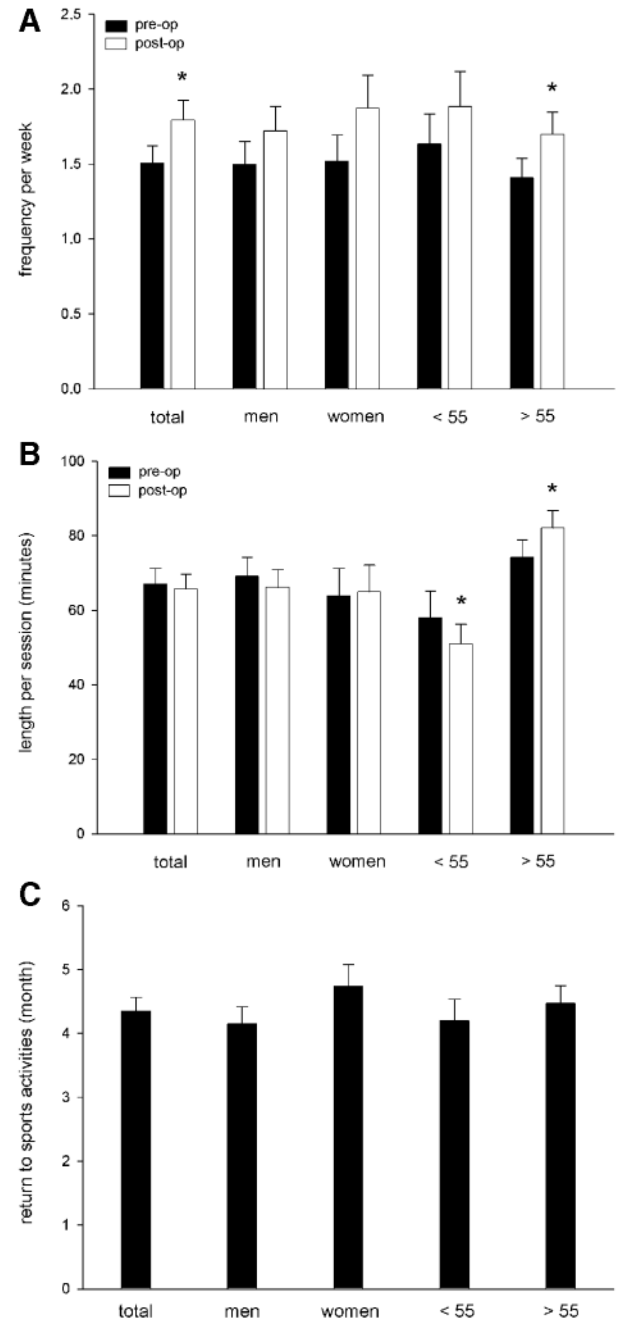


**Figure 2.** Preoperative and postoperative frequency (A), session length (B), and return to sports activities (C) for all patients with respect to gender (male and female) and age (≤55 and >55 years) (mean and standard error). Asterisk indicates significance ($P < .05$).

## Subjective Rating of Sports Abilities

The best subjective ratings (VAS, 0-10) were given for hip pain and overall satisfaction (Table 3). Hip pain during sports activities was low, with a mean score of 1.5 ± 1.9. Eighty-five percent (n = 58) of the patients reported no or very low pain (VAS, 0-3), 13% (n = 10) reported

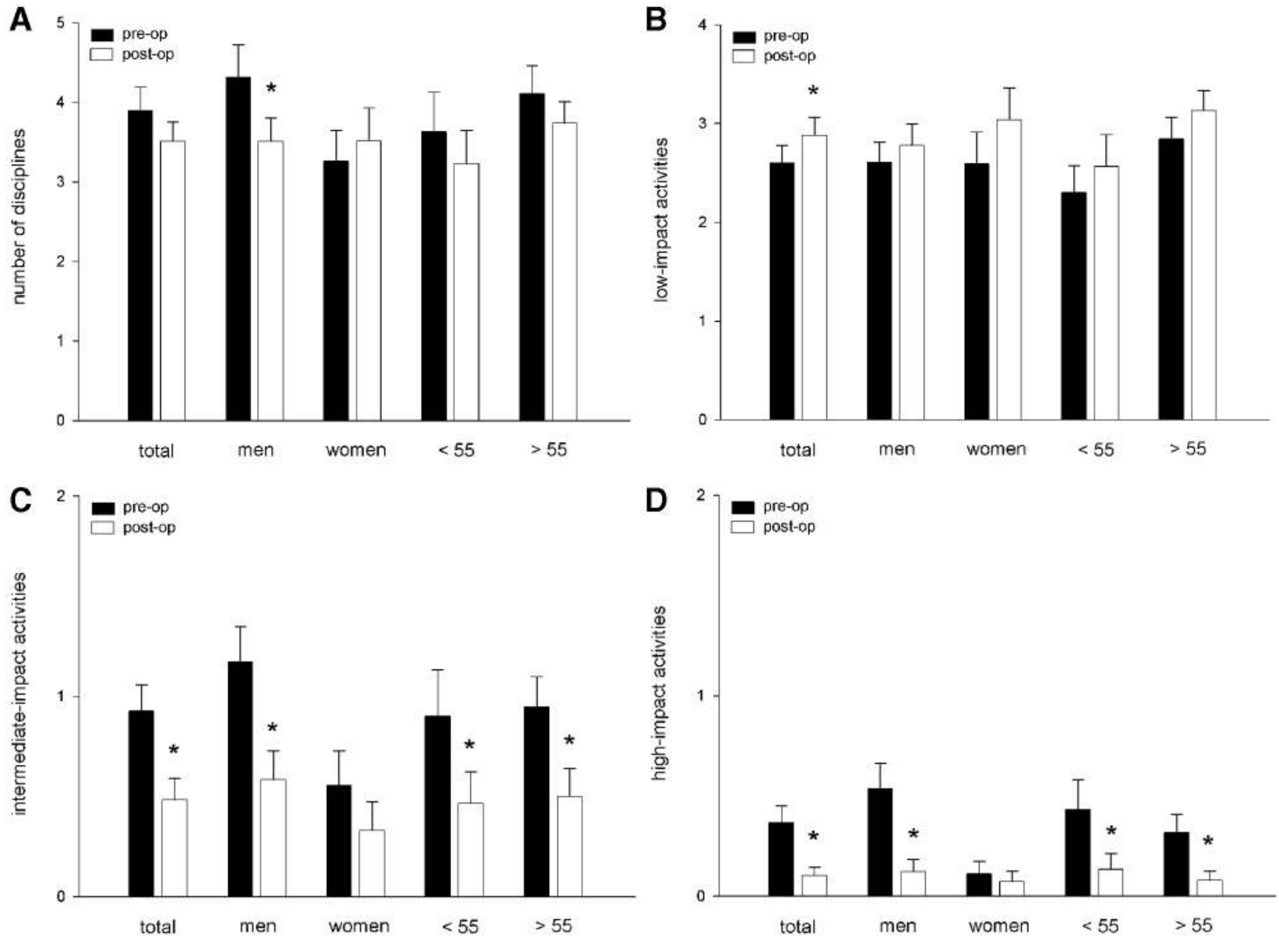


**Figure 3.** Preoperative and postoperative number of disciplines (A) as well as low-impact (B), intermediate-impact (C), and high-impact (D) activities for all patients with respect to gender (male and female) and age (≤55 and >55 years) (mean and standard error). Asterisk indicates significance ($P < .05$).

intermediate pain (VAS, 4-7), and only 2% (n = 1) reported severe pain (VAS, 8-10). The overall satisfaction was rated very well with an average score of 1.4 ± 2.3: 85% (n = 58) being very satisfied (VAS, 0-3), 9% (n = 6) intermediately satisfied (VAS, 4-6), and 6% (n = 4) not satisfied (VAS, 7-10). The postoperative ability to perform sports was rated 2.9 ± 2.3, the development of physical fitness was rated 3.6 ± 2.3, the subjective range of motion was rated 2.3 ± 2.2, and the insecurity/fear during sports activities was rated 2.6 ± 2.3. Analysis of the subgroups revealed that, on average, men and elderly patients rated their subjective outcome better than did women and young patients. This was, however, not significant in any of the categories.

## Restriction in Sports Activity

Restrictions in sports activities related to the hip replacement were reported by 40% (n = 27) of the patients. The reason most often mentioned was insecurity/fear to perform intermediate- and high-impact activities by 21% (n = 14) of the patients. Ten percent of the patients (n = 7) mentioned self-imposed limitations to take care of the implant. Only 6% (n = 4) reported a restriction because of decreased strength and 4% (n = 3) because of pain. Six percent (n = 4) were taking pain medication because of the operated hip. Finally, 45% (n = 31) reported at least one activity that they missed. Most of them were disciplines with an intermediate- or high-impact level such as downhill skiing (9%, n = 6), jogging (7%, n = 5), tennis/squash/badminton (9%, n = 6), and soccer/basketball (6%, n = 4). Fifty-five percent (n = 37) of the patients did not miss any sports at all.

## DISCUSSION

The excellent results obtained from hip arthroplasty have led to a steady increase in patient expectations, with a particular emphasis on returning to sports activities.[10] Total hip arthroplasty has shown good results but with the disadvantage of not conserving the femoral bone. In contrast to traditional femoral stems, short-stem implants conserve femoral bone stock, which is advantageous for potential revision surgeries. However, there are no data available

TABLE 2
Preoperative and Postoperative Activities in Patients With a Short-Stem Implant[a]

| Activity | Preoperative | Postoperative | Relative Change |
|---|---|---|---|
| Low impact | | | |
| Cycling | 69 | 69 | 0 |
| Hiking | 54 | 57 | +5 |
| Nordic walking | 12 | 18 | +50 |
| Gymnastics | 22 | 26 | +20 |
| Fitness/weight training | 22 | 38 | +73 |
| Dancing | 22 | 22 | 0 |
| Swimming | 57 | 56 | −3 |
| Golf | 1 | 1 | 0 |
| Intermediate impact | | | |
| Badminton | 7 | 3 | −60 |
| Inline skating | 4 | 1 | −67 |
| Tennis | 15 | 3 | −80 |
| Downhill skiing | 24 | 16 | −31 |
| Cross-country skiing | 21 | 15 | −29 |
| Riding | 7 | 3 | −60 |
| Martial arts | 4 | 1 | −67 |
| Bowling | 10 | 6 | −43 |
| Rock climbing | 1 | 1 | 0 |
| High impact | | | |
| Jogging | 9 | 3 | −67 |
| Handball | 1 | 0 | −100 |
| Volleyball | 7 | 3 | −60 |
| Basketball | 4 | 1 | −67 |
| Soccer | 9 | 1 | −83 |
| Squash | 7 | 0 | −100 |

[a]Data are presented as percentages.

TABLE 3
Subjective Outcome of Patients With a Short-Stem Implant Rated on the VAS[a]

| | Total | Men | Women | ≤55 Years | >55 Years |
|---|---|---|---|---|---|
| Sports ability (0-10) | 2.9 ± 2.3 | 2.7 ± 2.2 | 3.1 ± 2.5 | 2.9 ± 2.5 | 2.9 ± 2.2 |
| Fitness level (0-10) | 3.6 ± 2.3 | 3.4 ± 2.2 | 3.9 ± 2.3 | 4.0 ± 2.6 | 3.3 ± 1.9 |
| Range of motion (0-10) | 2.3 ± 2.2 | 1.8 ± 1.7 | 3.0 ± 2.8 | 2.3 ± 2.5 | 2.2 ± 2.0 |
| Insecurity/fear (0-10) | 2.6 ± 2.3 | 1.9 ± 1.9 | 3.8 ± 2.5 | 3.3 ± 2.6 | 2.2 ± 2.0 |
| Pain during sports (0-10) | 1.5 ± 1.9 | 1.1 ± 1.5 | 2.1 ± 2.3 | 2.0 ± 2.3 | 1.2 ± 1.5 |
| Overall satisfaction (0-10) | 1.4 ± 2.3 | 0.9 ± 1.7 | 2.1 ± 2.8 | 1.4 ± 2.3 | 1.3 ± 2.2 |

[a]Data are presented as mean ± standard deviation. Scores on the visual analog scale (VAS) range from 0 = good outcome to 10 = bad outcome.

about the ability to perform sports with this type of implant, which is the reason for designing the present study.

In our study, 91% of the patients were actively participating in sports before and also after SHA. Moreover, from the individuals who were active before surgery, 98% could return to sports activities. These numbers are clearly higher than previous data from conventional THA. Huch et al[11] found in 420 patients, 5 years after THA, an activity rate of 52%. Similarly, other studies reported a postoperative activity rate of about 50% after THA,[7,25,27] and only one described an activity rate of 83%.[5] However, our results are similar to 3 recent HRA studies, which reported 92% to 98% of patients participating in sports postoperatively.[2,23,24] Although several of our patients resumed sports activities earlier postoperatively, the majority restarted their sports activities after 5 to 6 months. This corresponds with previous studies[1,2,23] and is also recommended by the majority of surgeons.[14] In general, the patients resumed their activities with low-impact sports and then moved to high-impact sports afterward.[2]

Patients receiving SHA participated preoperatively in an average of 3.9 sports disciplines, which then decreased slightly to 3.5 disciplines after surgery. In contrast, previous studies addressing conventional THA reported fewer disciplines and a larger drop-off.[5,7,25] Chatterji et al[5] found that despite an increase in active patients after THA (80% preoperatively vs 83% postoperatively), the average number of sports decreased (1.9 preoperatively vs 1.7 postoperatively). Similarly, Dubs et al[7] reported an average of 2 sports disciplines after THA, and another study reported even fewer (1.4 preoperatively vs 0.9 postoperatively).[25] Our findings are comparable with the HRA studies of Banerjee et al[2] and Naal et al[23] (3.6 and 4.8 disciplines preoperatively vs 3.2 and 4.6 postoperatively, respectively). They also found that neither the frequency nor the duration decreased postoperatively but rather that they increased slightly. For conventional THA, 2 studies, only looking at tennis and golf, reported a postoperative frequency of 2.8 and 3.7 per week.[16,17] However, both studies evaluated an outstanding collective of active patients. In contrast, other THA studies reported lower frequencies and durations postoperatively.[11,25]

Several reasons might account for the better results obtained using SHA as compared with the older study results with THA. One important reason is the optimization of implantation techniques using less invasive surgery.[14] In SHA, it is further facilitated by the small size and curved design of the implant. Also, the steady improvement of biomechanical properties, like a more physiological load transmission in HRA or SHA, the recent use of larger femoral heads, and alternative bearing surfaces may contribute.[14] Finally, because of the excellent long-term results, patients are now undergoing hip replacement at a younger age, which probably allows rehabilitation to start from a better baseline level of physical fitness.

Although the number of sports changed slightly after surgery, there was a significant decrease in high-impact and a simultaneous increase in low-impact activities, which has similarly been described for HRA.[2,23] Forty-one percent of our patients still participated in intermediate- or high-impact sports postoperatively, and 21% were still cross-country or downhill skiing. However, it is known that young patients face a higher risk of early implant failure,[29] although the influence of high- and intermediate-impact activities still is not clarified. In accordance with most of the HS and AAHKS surgeons' recommendations, we encourage our patients to be active in low-impact sports and in intermediate sports if trained at a noncompetitive level and to be informed of the risks of high-impact sports should they wish to participate.[14,28]

Previous studies have reported higher sports activities among younger patients as compared with older patients.[11,26,32] In contrast, Naal et al[23] found a higher number of activities, a longer duration, and a higher frequency among older patients. This corresponds with our findings, as we also found a higher number of activities and a longer duration for the older age group. Naal et al[23] suggested that older people may have more leisure time to spend on sports activities. Similar to our results, they also reported less pain and a better subjective feeling in the older group.[23] However, as the clinical scores were comparable for both groups, the lower subjective rating of the younger patients might be explained by their higher expectations, as presumed by Naal et al.[22]

The gender-specific comparison revealed that men performed a higher number of sports than women preoperatively, which has also been reported by Banerjee et al.[2] And similar to us, they also saw a clear postoperative decrease in the number of sports for the male group. In our cohort, this was related to the high number of high- and intermediate-impact sports performed by men that decreased significantly after SHA. Despite an equal postoperative activity level, women rated their subjective outcome, like pain during sports, less than men. This may be associated with the relatively high percentage of unilateral and bilateral hip dysplasia in the female collective (48%). However, Naal et al[23] also reported that 19.2% of women experienced pain during sports versus only 12.2% of men. Nevertheless, the data show that patients can return to a good level of sports activity. And although high-impact activities are achievable, the majority of the patients tend to avoid them mainly because of a perceived need to protect the implant.

In our study, the greatest benefits were seen for pain reduction and improved range of motion. Only after these benefits came the ability to perform sports. Similarly, a study about patient expectations before and after THA reported that 78% were satisfied by their return to sports, but even more, 87% were satisfied with pain relief.[17] This information is relevant and should be used to counsel patients about participating in sports after hip replacement.

We are aware that our study has certain limitations. As a retrospective study, we did not perform a preoperative assessment, and the patients had to report information about their sports activities before surgery. And even though we used standardized questionnaires, there is always a bias because of the subjective rating of the patient. Nevertheless, it is well known that subjective parameters are important, as solely objective measurements like the range of motion do not represent the patient's outcome in its entirety.

In summary, this study shows that patients with a metaphyseally anchored and bone-conserving short-stem hip implant can return to a good level of sports activities. Most of the patients were highly satisfied, with men and the elderly group rating their subjective outcome slightly better than women and the younger individuals. Remarkably, the sports level and intensity of the activities were comparable with those in recent studies evaluating HRA.

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