



The predictive value of self-reported allergies for reoperation after index hip arthroscopy

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ABSTRACT

The purpose of this study is to compare the rate of reoperation after index hip arthroscopy for symptomatic femoroacetabular impingement in patients with, and without, at least one self-reported allergy. Data were collected prospectively in 1468 patients whose records were retrospectively reviewed. After the application of inclusion and exclusion criteria, two cohorts were formed: (i) a study cohort ($n = 261$) composed of patients with a self-reported allergy and (ii) a control cohort. ($n = 666$). The allergy cohort had a significantly larger [$P < 0.001$] reoperation rate (24.1% [63/261]) compared to the control cohort (9.6% [64/66]). Univariate analysis (UVA) and multivariate analysis (MVA) were then performed to better understand the implications of allergy status on the arthroscopic outcome. On UVA the presence of an allergy increased the odds of reoperation after index hip arthroscopy by 2.99 [OR (95% CI): 2.99 (2.04, 4.39); $P < 0.001$] and for each additional allergy a patient reported, their odds of subsequent surgery increased by 1.27 per allergy [OR (95% CI): 1.27 (1.15, 1.39); $P < 0.001$]. However, on the MVA, allergy status was not an independent risk factor for reoperation. These findings suggest that allergy status is associated with a higher reoperation rate, however, allergy status alone cannot prognosticate the risk of subsequent surgery. Therefore, allergy status and its association with future surgery after hip arthroscopy should be considered in the context of multiple patient-specific factors that influence the surgical outcome. An understanding of this association enables patient-centered care and will strengthen the physician–patient relationship.

INTRODUCTION

The increased use of hip arthroscopy in the treatment of femoroacetabular impingement (FAI) has been well-documented over the last 2 decades [1–4]. As such, factors that predict outcome after hip arthroscopy have been identified such as age, sex, BMI and Tonnis grade [5, 6]. However, there are additional patient-specific factors that may influence the arthroscopic outcome that has yet to be considerably investigated. Prior research has found that satisfaction with medical care correlates inferiorly with allergic-type symptoms [7] and that patients with axis I psychiatric issues may falsely report allergies [8]. Further, psychiatric comorbidity itself has been shown to adversely impact patient-reported outcomes in orthopedic literature in regards to pain level, daily function and post-operative rehospitalization [9, 10].

The relationship between self-reported allergies and outcomes following hip, knee and shoulder arthroplasty has been well-studied with evidence showing inferior patient-reported outcomes, lower preoperative function and less postoperative improvement in patients with self-reported allergies [11–14]. This topic has likewise recently been investigated in regards to hip arthroscopy with some studies finding a significant relationship between self-reported allergies and poor arthroscopic outcome while others have found no considerable association

[10, 15–18]. The primary metric used to assess the benefit of hip arthroscopy in these studies were patient-reported outcome measures (PROMs) which are a relevant and accurate method to evaluate the benefit of arthroscopic intervention despite their inherently subjective nature [19, 20]. Provided the conflicting results in the aforementioned studies, an investigation concerning self-reported allergies and reoperation rates after index arthroscopy would provide more objectively to the literature. However, to the best of our knowledge, no such literature exists concerning this topic.

Given this paucity of data, the purpose of this study is to compare the rate of reoperation after index hip arthroscopy for symptomatic FAI in patients with, and without, at least one self-reported allergy. Our primary hypothesis is that patients with at least one self-reported allergy will have significantly higher rates of subsequent hip surgery. Further, we hypothesize that the presence of an allergy will independently predict subsequent surgery risk after hip arthroscopy.

METHODS

This study was approved by our organization's Institutional Review Board (IRB). Data utilized in the present study were collected from 2006 to 2019 via a separate IRB-approved

hospital-wide registry. The registry is part of a multi-surgeon database that tracks outcome data for patients with symptomatic FAI. Patient demographics, PROM(s) and surgical data were collected prospectively at the time of patient presentation via the registry. A retrospective chart review was then completed to classify patients according to the presence or absence of an allergy. Allergy status was determined if a patient's medical record contained documentation of a specific drug, food, or environmental allergy. Allergies were determined to be absent if documentation made clear that a patient denied known allergies. Patients were excluded from the present study if allergy status could not be explicitly determined based on chart review.

All patients included in the analysis were assessed before and after hip arthroscopy with four hip-specific PROMs: the modified Harris Hip Score (mHHS) [21], Hip Outcome Score—Activities of Daily Living (HOS-ADL) [22], Hip Outcome Score—Sports Subscale (HOS-SS) [23] and the 33-item International Hip Outcome Tool (iHOT-33) [24]. All postoperative PROMs in the present study were collected within 1 year of hip arthroscopy. Previously established values for the minimal clinically important difference (MCID) were used as metrics of significant clinical improvement. MCID values of 8.2, 8.3, 14.5 and 12.1 [25] were used on mHHS, HOS-ADL, HOS-SS and iHOT-33, respectively.

Exclusion criteria consisted of (i) previous ipsilateral hip surgery, (ii) Tonnis grade >1, and (iii) patients with a history of a traumatic ipsilateral hip injury. After the application of this criteria, 1468 patients were included in the initial chart review. Medical records were then reviewed to identify patients who (i) underwent subsequent hip surgery, or (ii) did not require additional surgery and had a minimum follow-up of at least 24 months (median follow-up of 51.1 months). Of note, subsequent hip surgeries were defined as any unplanned ipsilateral hip surgery that occurred after index hip arthroscopy. Additionally, allergy status was determined during chart review.

After application of the above criteria, 131 patients were identified who underwent subsequent hip surgery, however, 4 of these patients did not have documentation of allergy status and were therefore excluded. Of the 1337 remaining patients who did not undergo subsequent hip surgery, 537 were excluded due to inadequate follow-up time and/or absence of documented allergy status leaving 800 of them for inclusion in the study. In total, this allowed for 927 patients to be included in the final analysis. Two cohorts were formed based on the presence or absence of a self-reported allergy: an allergy cohort ($n = 261$) and a control cohort ($n = 666$).

STATISTICAL ANALYSIS

In each cohort, patient demographics and treatment-related characteristics were described. Continuous variables were reported as means with ranges and standard deviation, while categorical variables were reported as counts with percentages. Chi-square or Fisher tests and t -tests were used to compare categorical and continuous variables between the two cohorts, respectively. Univariate logistic regression analysis (UVA) was used to assess the association between various parameters and the outcome of interest which in the present study was subsequent hip surgery. Covariates significant on UVA were included

in a multivariable logistic regression analysis (MVA). All statistical analyses were performed using RStudio version 1.2.1335. All P -values were reported with a level of significance of 0.05.

RESULTS

Basic demographic information is reported in Table I. The allergy cohort had a significantly higher age [$P < 0.001$] and proportion of females [$P < 0.03$]. The average number of allergies reported per person in the allergy cohort was 2.4 ± 2.7 .

Indications for hip arthroscopy as well as specific procedures performed during hip arthroscopy are included in Table II. The most common indication for hip arthroscopy in both the allergy cohort and control cohort was a labral tear (96.9% versus 96.4%), followed by cam-type FAI (87.1% versus 90.1%) and pincer-type FAI (28.6% versus 31.8%). The most common intraoperative procedure performed was a cam decompression in both the allergy cohort and control cohort (89.7% versus 91.3%), followed by a labral repair (84.4% versus 83.7%) and a rim decompression (27.2% versus 31.1%). No significant difference existed between cohorts with respect to preoperative diagnoses and intraoperative procedures.

Data concerning revision surgery is reported in Table III. The average time to subsequent surgery in the allergy cohort was 34.2 months (± 24.2 months) while the average time to subsequent hip surgery in the control cohort was 35.6 months (± 29.6 months). The allergy cohort had a significantly larger [$P < 0.001$] percentage of patients undergoing subsequent hip surgery (24.1% [63/261]) compared to the reoperation rate seen in the control cohort (9.6% [64/666]). Of the 63 patients in the allergy cohort who underwent subsequent hip surgery, 38 (60.3%) underwent revision hip arthroscopy, 14 (22.2%) underwent total hip arthroplasty (THA), 6 (9.5%) underwent periacetabular osteotomy (PAO), 3 (4.8%) underwent hip resurfacing and 2 (3.2%) underwent surgical hip dislocation (SHD). Of the 64 patients in the control cohort who underwent subsequent hip surgery, 35 (54.7%) underwent revision hip arthroscopy, 15 (23.4%) underwent THA, 9 (14.1%) underwent hip resurfacing, 4 (6.3%) underwent PAO and 1 (1.6%) underwent SHD. No significant difference was seen between cohorts regarding the type(s) of subsequent hip surgery.

Univariate (UVA) and multivariate (MVA) analyses are presented in Table IV. Variables included as parameters in the analysis include (i) age at surgery, (ii) sex, (iii) presence of allergy, (iv) cumulative effect of multiple allergies, (v) baseline PROM score on mHHS, HOS-ADL, HOS-SS and iHOT-33, (vi) failure to achieve the MCID within 12 months of surgery on mHHS, HOS-ADL, HOS-SS and iHOT-33, (vii) labral repair at the time of arthroscopy, (viii) cam decompression at time of arthroscopy, and (ix) rim decompression at time of arthroscopy. No significant association was found on UVA with respect to sex, baseline PROM score, cam decompression and rim decompression.

On UVA both allergy status and cumulative allergies were found to be significant. The presence of an allergy increased odds of subsequent surgery after hip arthroscopy by 2.99 [OR (95% CI): 2.99 (2.04, 4.39); $P < 0.001$] while for each additional allergy a patient reported their odds of subsequent surgery increased 1.27 per allergy [OR (95% CI): 1.27 (1.15, 1.39); $P < 0.001$]. Other parameters that were significant on UVA

Table I. Demographic info

	Allergy cohort (n = 261)		Control cohort (n = 666)		P-value
	n (%)	Mean ± SD	n (%)	Mean ± SD	
Age	–	27.5 ± 6.9	–	25.5 ± 6.0	<0.001
Sex (female)	137 (52.50%)	–	295 (44.30%)	–	0.03
# of allergies	–	2.4 ± 2.7	–	–	–
Side (left)	126 (48.30%)	–	289 (43.40%)	–	0.204

Table II. Pre-operative diagnosis and intra-operative procedures

	Allergy cohort	Control cohort	P-value
	(n = 261)	(n = 666)	
	n (%)	n (%)	
Preoperative diagnosis			
Labral tear	217 (96.9%)	621 (96.4%)	0.918
Cam impingement	195 (87.1%)	580 (90.1%)	0.259
Pincer impingement	64 (28.6%)	205 (31.8%)	0.409
Intra-operative procedures			
Labral repair	189 (84.4%)	539 (83.7%)	0.895
Cam decompression	201 (89.7%)	588 (91.3%)	0.569
Rim decompression	61 (27.2%)	207 (32.1%)	0.198

included age [OR (95% CI): 1.14 (1.11, 1.18); $P < 0.001$], failing to achieve the MCID by 12 months on mHHS [OR (95% CI): 5.94 (3.07, 11.47); $P < 0.001$], HOS-ADL [OR (95% CI): 4.75 (2.44, 9.23); $P < 0.001$], HOS-SS [OR (95% CI): 3.36 (1.67, 6.76); $P < 0.001$] and iHOT-33 [OR (95% CI): 2.81 (1.38, 5.72); $P = 0.004$]. Of note, the presence of a labral repair at the time of arthroscopy was the only factor on UVA that decreased the odds of subsequent hip surgery [OR (95% CI): 0.42 (0.24, 0.72); $P = 0.002$].

MVA was then completed with covariates that showed significance on UVA. Both allergy status and cumulative allergies failed to independently predict the risk of subsequent hip surgery after hip arthroscopy in a significant manner. Other factors that were also insignificant on the MVA included age, failing to achieve the MCID on HOS-SS and iHOT-33 and a labral repair at the time of surgery. The only two factors that significantly predicted the risk of subsequent hip surgery was the failure to achieve the MCID by 12 months on mHHS [OR (95% CI): 3.09 (1.15, 8.32);

$P = 0.026$] and failure to achieve the MCID by 12 months on HOS-ADL [OR (95% CI): 3.18 (1.11, 9.14); $P = 0.032$].

DISCUSSION

The results of this study support our primary hypothesis that patients with at least one self-reported allergy have significantly higher rates of subsequent hip surgery after primary hip arthroscopy with almost 25% of the allergy cohort undergoing subsequent surgery versus less than 10% of the control cohort. While the UVA did find that the presence of an allergy had a significant association with revision risk and that for each allergy a patient reported their odds of subsequent surgery increased significantly, the MVA showed that allergy status was not an independent prognosticator of revision surgery after primary hip arthroscopy. Therefore, the results of the present study did not support our secondary hypothesis.

The results of this study suggest that the relationship between allergy status and surgical outcome is complex in nature with allergy status having a significant association with revision surgery on UVA but failing to significantly predict revision risk after primary arthroscopy on MVA. In contrast, failure to achieve the MCID on 2 of the 4 included PROMs (mHHS & HOS-ADL) was significant on MVA as independent risk factors for revision surgery which is consistent with the results of other investigations [26–29]. Given that patient-reported allergies have been extensively documented to impact patient-reported outcomes [14, 16–18], it is likely in the present study that allergy status impacted achievement rates of the MCID which itself is a strong parameter in predicting surgical outcome after hip arthroscopy. The MVA provides nuance to the results seen with the cohort analysis and UVA as the MVA reveals that despite the allergy cohort's larger reoperation rate, allergy

Table III. Additional surgeries

	Allergy cohort (n = 261)		Control cohort (n = 666)		P-value
	n (%)	Mean ± SD	n (%)	Mean ± SD	
Months to surgery		34.2 ± 24.2		35.6 ± 29.6	0.782
Total # of surgeries	63 (24.1%)		64 (9.6%)		<0.001
Hip arthroscopy	38 (60.3%)		35 (54.7%)		
THA ^a	14 (22.2%)		15 (23.4%)		
Hip resurfacing	3 (4.8%)		9 (14.1%)		0.431
PAO ^b	6 (9.5%)		4 (6.3%)		
SHD ^c	2 (3.2%)		1 (1.6%)		

^aTotal hip arthroplasty (THA).

^bPeriacetabular osteotomy (PAO).

^cSurgical hip dislocation (SHD).

Table IV. Univariate analysis and multivariate analysis

Parameter	Univariate analysis			Multivariate analysis		
	OR	95% CI	P	Adj. OR	95% CI	P
Age	1.14	1.11–1.18	<0.001	1.01	0.94–1.08	0.826
Sex ^a	0.75	0.52–1.09	0.135	–	–	–
Allergy	2.99	2.04–4.39	<0.001	2.11	0.75–5.95	0.158
Cumulative allergy	1.27	1.15–1.39	<0.001	0.92	0.65–1.30	0.625
Baseline PROM ^b						
mHHS ^c	0.999	0.98–1.018	0.900	–	–	–
HOS-ADL ^d	0.997	0.983–1.012	0.723	–	–	–
HOS-SS ^e	0.998	0.987–1.009	0.727	–	–	–
iHOT-33 ^f	1.000	0.985–1.016	0.992	–	–	–
Failure to achieve MCID ^g ≤12 months post-op						
mHHS	5.94	3.07–11.47	<0.001	3.09	1.15–8.32	0.026
HOS-ADL	4.75	2.44–9.23	<0.001	3.18	1.11–9.14	0.032
HOS-SS	3.36	1.67–6.76	<0.001	0.88	0.30–2.60	0.815
iHOT-33	2.81	1.38–5.72	0.004	0.85	0.32–2.23	0.742
Intra-op procedures						
Labral repair	0.42	0.24–0.72	0.002	0.70	0.07–6.93	0.759
Cam decompression	0.58	0.28–1.18	0.132	–	–	–
Rim decompression	0.94	0.55–1.59	0.805	–	–	–

^aCalculated as risk of being male.

^bPatient reported outcome measure (PROM).

^cModified Harris Hip Score (mHHS).

^dHip Outcome Score—Activities of Daily Living (HOS-ADL).

^eHip Outcome Score—Sports specific (HOS-SS).

^f33-item international Hip Outcome Tool (iHOT-33).

^gMinimal Clinically Important Difference.

status alone is not a significant risk factor for subsequent hip surgery.

Ultimately, a reasonable conclusion that can be inferred from the above findings is that allergy status should be considered in the context of multiple patient-specific factors that influence arthroscopic outcomes. Based on the results in this study, as well as the results of prior investigations [14, 18], it is evident that allergy status is linked to arthroscopic outcome. However, this association is complex in nature and likely reflects the impact of various psychosomatic factors on arthroscopic outcomes. Studies have shown that self-reported allergies associate with pre-existing psychiatric conditions and prognosticate risk of developing mood and anxiety disorders in the future [16, 30]. This association may explain the results of the present study and similar investigations because psychological factors can influence the postoperative course and compromised mental wellness increases the likelihood of inferior patient-reported outcomes [14, 18, 31, 32]. Further, preoperative mental health conditions associated with reduced postoperative hip function and poor surgical outcomes [15, 17, 33]. However, mental health well-being and its relationship with allergy status were not analyzed in the present study as it was outside of its original scope. As such, the impact of mental health on the results found in this analysis cannot be stated. Additional investigations are required to better define the relationship between allergy status, mental health and arthroscopic outcomes.

It is worthwhile to consider the reoperation rate in the allergy cohort in this study along with the patient-reported outcomes published in other investigations. Research has shown

considerable intra-group improvement from baseline PROM scores and high achievement rates of the MCID in allergy cohorts despite inferior results when compared to the outcomes of a control group [10, 18]. Thus, a clinician should be cautious when extrapolating data about mental health and/or allergy status toward arthroscopic outcome given the notable improvements many of these patients report from their baseline state. Rather, an understanding of the association between allergies, mental health and the arthroscopic outcome will strengthen the physician-patient relationship and enable patient-centered care.

The strength of this study relates to the large sample size, the use of objective outcome criteria in the form of subsequent surgical intervention, and the robust statistical analysis that was completed. To our knowledge, this is the first investigation into subsequent surgery rates in patients with and without a reported allergy who underwent hip arthroscopy for symptomatic FAI.

This study has its limitations. Foremost, data utilized in the present study were collected in a registry-based manner at a single medical institution which limits the generalizability of the results. Allergy status was ascertained retrospectively after being documented at the time of presentation in an electronic medical record. This presents a possible confounding variable as prior studies have shown that allergies can sometimes be recorded incorrectly or absently [14, 18]. Another limitation was the discrepancy between cohorts regarding age and sex. While this limitation was somewhat circumvented by including both variables as parameters in the UVA and MVA, future studies could improve upon our design. Additional confounding variables include the absence of BMI data, radiographic results

and physical exam findings. This information was not available for all participants and therefore not included. Mental health status was not included as it was not available for every subject and ultimately outside this study's scope. Nevertheless, an investigation into mental health wellbeing would have strengthened this study and remains an area to explore in the future. Lastly, this study did not explore the reason for revision hip surgery in patients who underwent reoperation. The decision to undergo subsequent surgery reflects multiple patient-specific clinical and personal factors which could have differed between cohorts.

Despite these limitations, this study provides the first analysis on the relationship between self-reported allergies and the rate of subsequent surgical intervention following hip arthroscopy. Future research in the form of prospective studies that control for additional confounding variables will better determine the nature of arthroscopic outcomes for patients with self-reported allergies.

CONCLUSION

The results of this study support our primary hypothesis that patients with at least one self-reported allergy have significantly increased rates of subsequent hip surgery after index hip arthroscopy. However, further analysis revealed that while allergy status carries a significant association with reoperation after primary hip arthroscopy, it fails to independently predict revision risk. An understanding of this association will permit patient-centered care and ultimately strengthen the physician-patient relationship.

DATA AVAILABILITY

Data supporting the findings of this study are available from the corresponding author (S.S) on request.

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CONFLICT OF INTEREST STATEMENT

None declared.

REFERENCES

- Zhang AL, Feeley BT. Editorial commentary: the rise of hip arthroscopy: temporary trend or here to stay? *Arthroscopy* 2018; **34**: 1831–2.
- Bozic KJ, Chan V, Valone FH *et al*. Trends in hip arthroscopy utilization in the United States. *J Arthroplasty* 2013; **28**: 140–3.
- Maradit Kremers H, Schilz SR, Van Houten HK *et al*. Trends in utilization and outcomes of hip arthroscopy in the United States between 2005 and 2013. *J Arthroplasty* 2017; **32**: 750–5.
- Lee Y-K, Ha Y-C, Yoon B-H *et al*. National trends of hip arthroscopy in Korea. *J Korean Med Sci* 2014; **29**: 277–80.
- Sogbein OA, Shah A, Kay J *et al*. Predictors of outcomes after hip arthroscopic surgery for femoroacetabular impingement: a systematic review. *Orthop J Sport Med* 2019; **7**: 6.
- Mygind-Klavsen B, Lund B, Nielsen TG *et al*. Danish hip arthroscopy registry: predictors of outcome in patients with femoroacetabular impingement (FAI). *Knee Surg Sports Traumatol Arthrosc* 2019; **27**: 3110–20.
- Hausteiner C, Bornschein S, Bubel E *et al*. Psychobehavioral predictors of somatoform disorders in patients with suspected allergies. *Psychosom Med* 2009; **71**: 1004–11.
- Patten SB, Williams JVA. Self-reported allergies and their relationship to several axis I disorders in a community sample. *J Psychiatry Med* 2007; **37**: 11–22.
- Buller LT, Best MJ, Klika AK *et al*. The influence of psychiatric comorbidity on perioperative outcomes following primary total hip and knee arthroplasty; a 17-year analysis of the National Hospital Discharge Survey database. *J Arthroplasty* 2015; **30**: 165–70.
- Ramos N, Gerhardt M, Banffy M. Hip arthroscopy for femoroacetabular impingement (FAI) patients with self-reported allergies: do multiple allergies have an effect on outcome? *J Hip Preserv Surg* 2019; **6**: 346–52.
- Otero JE, Graves CM, Gao Y *et al*. Patient-reported allergies predict worse outcomes after hip and knee arthroplasty: results from a prospective cohort study. *J Arthroplasty* 2016; **31**: 2746–9.
- McLawnhorn AS, Bjerke-Kroll BT, Blevins JL *et al*. Patient-reported allergies are associated with poorer patient satisfaction and outcomes after lower extremity arthroplasty: a retrospective cohort study. *J Arthroplasty* 2015; **30**: 1132–6.
- Elrick BP, Johannsen AM, Dornan GJ *et al*. Patient-reported drug and latex allergies negatively affect outcomes after total and reverse shoulder arthroplasty. *J Shoulder Elbow Surg* 2021; **30**: 2753–61.
- Graves CM, Otero JE, Gao Y *et al*. Patient reported allergies are a risk factor for poor outcomes in total hip and knee arthroplasty. *J Arthroplasty* 2014; **29**: 147–9.
- Benditz A, Jansen P, Schaible J *et al*. Psychological factors as risk factors for poor hip function after total hip arthroplasty. *Ther Clin Risk Manag* 2017; **13**: 237.
- Aberle D, Wu SE, Oklu R *et al*. Association between allergies and psychiatric disorders in patients undergoing invasive procedures. *Psychosomatics* 2017; **58**: 490–5.
- Dick AG, Smith C, Bankes MJK *et al*. The impact of mental health disorders on outcomes following hip arthroscopy for femoroacetabular impingement syndrome: a systematic review. *J Hip Preserv Surg* 2020; **7**: 195–204.
- Swartwout EL, Feingold JD, Wright-Chisem JI *et al*. Self-reported allergies correlate with a worse patient-reported outcome after hip arthroscopy: a matched control study. *J Hip Preserv Surg* 2021; **7**: 670–6.
- Bernstein DN, Nwachukwu BU, Bozic KJ. Value-based health care: moving beyond “minimum clinically important difference” to a tiered system of evaluating successful clinical outcomes. *Clin Orthop Relat Res* 2019; **477**: 945–7.
- Ramisetty N, Kwon Y, Mohtadi N. Patient-reported outcome measures for hip preservation surgery—a systematic review of the literature. *J Hip Preserv Surg* 2015; **2**: 15.
- Byrd JW. Hip arthroscopy: patient assessment and indications. *Instr Course Lect* 2003; **52**: 711–9.
- Martin RL, Kelly BT, Philippon MJ. Evidence of validity for the hip outcome score. *Arthroscopy* 2006; **22**: 1304–11.
- Ri M, Mj P. Evidence of validity for the hip outcome score in hip arthroscopy. *Arthroscopy* 2007; **23**: 822–6.
- Nwachukwu BU, Chang B, Beck EC *et al*. How should we define clinically significant outcome improvement on the iHOT-12? *HSS J* 2019; **15**: 103–8.
- Nwachukwu BU, Fields K, Chang B *et al*. Preoperative outcome scores are predictive of achieving the minimal clinically important difference after arthroscopic treatment of femoroacetabular impingement. *Am J Sports Med* 2017; **45**: 612–9.
- Rosinsky PJ, Chen JW, Yelton MJ *et al*. Does failure to meet threshold scores for mHHS and iHOT-12 correlate to secondary operations following hip arthroscopy? *J Hip Preserv Surg* 2020; **7**: 272–80.

27. Kester BS, Capogna B, Mahure SA *et al*. Independent risk factors for revision surgery or conversion to total hip arthroplasty after hip arthroscopy: a review of a large statewide database from 2011 to 2012. *Arthroscopy* 2018; **34**: 464–70.
28. Saadat E, Martin SD, Thornhill TS *et al*. Factors associated with the failure of surgical treatment for femoroacetabular impingement: review of the literature. *Am J Sports Med* 2014; **42**: 1487–95.
29. Feingold JD, Swartwout EL, Roberts SA *et al*. Failure to achieve threshold scores on patient-reported outcome measures within 1 year has a predictive risk of subsequent hip surgery within 5 years of primary hip arthroscopy: a case-control study. *Orthop J Sport Med* 2021; **9**: 2325967121110530.
30. Oh H, Koyanagi A, DeVlylder JE *et al*. Seasonal allergies and psychiatric disorders in the United States. *Int J Environ Res Public Health* 2018; **15**: 1965.
31. Ferrer T, Hinarejos P, Goicoechea N *et al*. Anxiety is the cause of the worse outcomes of allergic patients after total knee arthroplasty. *Knee Surg Sports Traumatol Arthrosc* 2020; **28**: 3135–41.
32. Hirschmann MT, Testa E, Amsler F *et al*. The unhappy total knee arthroplasty (TKA) patient: higher WOMAC and lower KSS in depressed patients prior and after TKA. *Knee Surg Sports Traumatol Arthrosc* 2013; **21**: 2405–11.
33. Cheng AL, Schwabe M, Doering MM *et al*. The effect of psychological impairment on outcomes in patients with prearthritic hip disorders: a systematic review and meta-analysis. *Am J Sports Med* 2020; **48**: 2563–71.