Journal of Hip Preservation Surgery Vol. 4, No. 4, pp. 308–317
doi: 10.1093/jhps/hnx023
Advance Access Publication 15 June 2017
Research article

OXFORD

Does duration of symptoms affect clinical outcome after hip arthroscopy for labral tears? Analysis of prospectively collected outcomes with minimum 2-year follow-up

Brian D. Dierckman[1]*, Jake Ni[1], Eric A. Hohn[1] and Benjamin G. Domb[2]

[1]Southern California Orthopedic Institute, 6815 Noble Avenue, Van Nuys, CA 91405, USA and
[2]American Hip Institute, Adventist Hinsdale Hospital, 550 W Ogden Avenue, Chicago, IL 60521, USA
*Correspondence to: B. D. Dierckman. E-mail: bdierckman@scoi.com
Submitted 10 January 2017; Revised 28 March 2017; revised version accepted 26 April 2017

ABSTRACT

Limited research exists on the possible association between duration of symptoms and clinical outcomes following hip arthroscopy for labral tears. The purpose of this study was to evaluate whether duration of symptoms affected clinical and patient-reported outcome (PRO) scores following hip arthroscopy for labral tears. From 2008 to 2011, data were collected prospectively on all patients undergoing primary hip arthroscopy for labral tears. Workers' compensation cases, dysplasia cases and patients with previous ipsilateral hip surgeries were excluded. A total of 738 patients were identified with a minimum of 2-year follow-up, and clinical and PRO data were available for 680 patients. Uni- and multivariate analyses were performed to determine the relationship between duration of symptoms along with other variables and PROs. Overall, patients experienced significant improvements in all clinical and PRO scores. Results of univariate analysis revealed that all PROs were negatively associated with increasing Log_{10} months of symptoms as were pain and satisfaction scores. During multivariate analyses, increasing Log_{10} months of symptoms, age, body mass index and trauma were all negatively associated with PROs ($P < 0.05$). Our study demonstrates that clinical and PRO scores were negatively associated with increasing duration of symptoms prior to hip arthroscopy for treatment of labral tears. Although this implies that delay in treatment may adversely affect outcome, conservative treatment remains the gold standard first line of treatment. Surgeons should incorporate this information into their treatment algorithm to maximize patient outcomes following treatment for labral tears.

Level of evidence: Level IV, prospective case series.

INTRODUCTION

Labral tears of the hip are a common source of pain and dysfunction. The labrum has been shown to be critical to long-term health of the hip joint. It deepens the acetabulum, creates a suction fit seal for normal joint fluid hydrodynamics and provides stability to the joint itself, both by directly restricting translation and by maintaining a negative intra-articular pressure [1–5]. The loss of the normal biomechanical function of the labrum leads to cartilage damage, progressive joint degeneration and eventual arthrosis [6, 7]. Femoroacetabular impingement (FAI) is the most common cause of labral tears in the hip, with other causes including acute trauma, instability, dysplasia and degenerative changes [8].

Conservative measures are the preferred initial treatment for labral tears of the hip. Non-surgical options including physical therapy, non-steroidal anti-inflammatories, activity modifications and intra-articular corticosteroid injections have been shown to be beneficial [8] however, no consensus has been established regarding the duration of conservative treatment before surgery is indicated. In addition, it remains unclear which patients will respond better to conservative measures.

Hip arthroscopy has become the surgical treatment of choice for labral tears in the US, and the results have been good or excellent in the majority of patients [9–11]. However, concern exists that continued and progressive damage to the labrum and/or cartilage prior to surgery may lead to long-term joint degeneration and diminished outcomes [12]. Because of the risk of progressive and potentially irreversible damage, some surgeons advocate earlier surgical intervention; intuitively however, this may lead to overtreatment.

Few studies have evaluated an association between duration of symptoms prior to surgery and outcomes following hip arthroscopy and results have been conflicting [12, 13]. The purpose of this study was to determine if patient reported outcome (PRO) scores correlated with duration of symptoms prior to hip arthroscopy for labral tears. We hypothesized that increasing duration of symptoms would lead to decreased PROs following hip arthroscopy.

MATERIALS AND METHODS

At our institution, clinical and PRO data are prospectively collected on all patients undergoing hip arthroscopy. We performed a retrospective query of our institutional database for all patients who underwent hip arthroscopy for a labral tear with minimum 2 years' follow-up. The study period was from 2008 to 2011. Our institutional review board approved this study.

Symptom duration was measured by calculating the time between initial onset of pain (reported on patient intake forms) and day of surgery. Patient reported outcome (PRO) scores including the modified Harris Hip Score (mHHS), the Non-Arthritic Hip Score (NAHS), the Hip Outcome Score–Activities of Daily Living (HOS-ADL) and the Hip Outcome Score–Sport-Specific Subscale (HOS-SSS) were obtained preoperatively, and at 3-months, 1-year and 2-years following surgical intervention. These PROs were collected at clinical follow-up visits when possible, or via email otherwise. In addition, pain and patient satisfaction ratings were obtained. The visual analog scale (VAS) pain score was measured on a scale from 0 to 10, with 0 being no pain and 10 being severe pain. Patient satisfaction was measured on a scale from 0 to 10, with 0 being completely unsatisfied and 10 being completely satisfied. Any conversion to total hip arthroplasty (THA) was noted.

The inclusion criteria for our study included failure of conservative measures (including 6 weeks of physical therapy), a magnetic resonance arthrogram (MRA) confirming a labral tear, Tönnis grade 0 or 1 joint space [14] and a minimum 2-years' follow-up. Exclusion criteria included workers' compensation cases, dysplasia (lateral center-edge angle below 25°) [15] and history of prior surgery on the affected hip.

Clinical evaluation

Clinical evaluation and radiographic assessments were performed by the senior author (BGD) at each visit. Patients were seen preoperatively and 3 months, 6 months, 1 year and 2 years postoperatively. Plain radiographs obtained at the initial visit included an anteroposterior pelvic view, Dunn view, cross-table lateral view and a false profile view. Measurements were made from these views, including the Tönnis angle (acetabular inclination angle) using the method described by Jessel *et al.* [16], the lateral center edge angle of Wiberg [15], joint space at its narrowest point in millimeters, crossover sign [17], alpha angle and femoral head-neck offset in millimeters. The alpha angle was measured on the Dunn view using the method described by Nötzli *et al.* [18] and on magnetic resonance imaging using the modified technique described by Meyer *et al.* [19]. All radiographs were graded with the Tönnis classification of osteoarthritis [14].

Clinical assessment included range of motion and strength assessment, anterior apprehension test and flexion/adduction/internal rotation (FADIR) test to assess for impingement. In equivocal cases, diagnostic intra-articular injections were performed with ultrasound guidance. MRA was obtained in all patients and was read by a fellowship trained musculoskeletal radiologist, and confirmed by the senior author (BGD).

Surgical technique

All hip arthroscopies were performed by the senior author (BGD). Hip arthroscopy was performed with the patient in the modified supine position on a traction table with a well-padded perineal post. Access to the joint was gained through a standard anterolateral portal, an anterior portal placed under direct visualization, and a distal anterolateral accessory portal for labral repair [20]. The capsule was cut parallel to the labrum, connecting the anterior and anterolateral portals and extending medially as needed to address intra-articular lesions. A T-cut capsulotomy was not performed. Routine diagnostic arthroscopy was performed in all cases. Concomitant procedures were performed if indicated: LT debridement with a radiofrequency device in the case of LT tear; chondroplasty with a motorized shaver for unstable, loose cartilage lesions; microfracture for Outerbridge grade IV lesions after chondral debridement [21]; and iliopsoas fractional lengthening if the patient had pain with internal snapping of the hip noted on preoperative examination or if there was an iliopsoas impingement lesion on the labrum [22]. Figures 1 and 2 show intra-

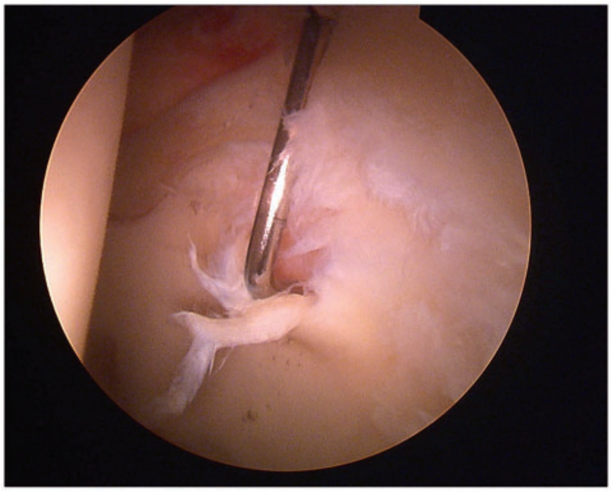

Fig. 1. Supine arthroscopy of the left hip viewed from a lateral portal. The probe is examining a loose unstable cartilaginous flap at the base of a torn labrum from the anterior portal.

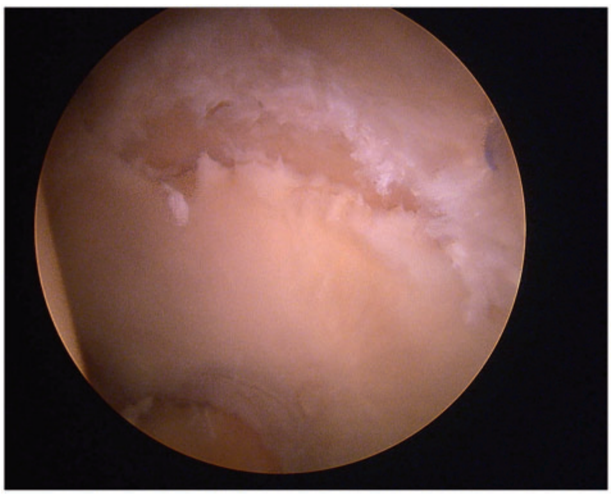

Fig. 2. Supine arthroscopy of the left hip viewed from a lateral portal. View of the same area after debridement of the unstable cartilaginous flap and labral repair.

operative arthroscopic images of a supine left hip viewed from the lateral portal. Intra-operative data were collected on all patients, including the location of labral tears and procedures performed on the labrum, capsule, acetabulum, femoral head-neck junction and iliopsoas tendon.

As a general treatment algorithm, pincer impingement was treated with acetabuloplasty and cam impingement with femoroplasty. Femoroplasty was performed with the goal of restoration of normal femoral head-neck offset and normal sphericity with an alpha angle under 50°. Labral repair was performed when sufficient labral tissue remained following debridement; repair type (simple circumferential loop stitch vs. labral base refixation) was chosen based upon labral thickness and tissue quality [23]. Labral reconstruction with iliotibial band autograft was performed in cases of insufficient or segmental labral deficiency [24]. The capsule was repaired routinely except in whom a release was considered to be therapeutic, such as patients with stiff hips or thickened capsules.

Postoperatively, all patients followed a standard physical therapy rehabilitation protocol initiated within 5 days postoperatively. Crutches were used for 2 weeks with foot flat weight bearing with patients weaning from crutches as gait improved over the next 2 weeks. A hip orthosis was used on all patients for the first 2 weeks postoperatively. Patients were allowed to begin a walk-jog program at 3 months postoperatively, and were cleared to return to all athletics at a minimum of 6 months after surgery.

Statistical analysis

Descriptive statistics were used for patient demographic data and procedures performed. The paired Student *t*-test was used to test for significance of differences between various groups of continuous variables (Microsoft Excel; Microsoft, Redmond, WA). Uni- and multivariate analyses were performed to examine the predictors of increases or decreases from pre- to postoperatively in all four PRO scores (mHHS, NAHS, HOS-ADL and HOS-SSS). Eight potential preoperative predictors were simultaneously considered for each PRO: age, sex, Log_{10} months of symptoms, BMI, acute injury, high-energy trauma, labral treatment and capsular treatment. The degree of chondrolabral injury was not available for this study and was therefore could not be analyzed as an independent variable. A strict P values of <0.05 was used to define significance. Regression analysis was used to account for the ceiling effect of the various PROs. For univariate analysis of correlations with VAS and satisfaction, step-down backward robust linear regression was used. Spline analyses revealed that duration of symptoms had a nearly linear relationship with Log_{10} months of symptoms.

RESULTS

In total, 868 patients were identified, 739 of which had a minimum of 2 years' follow-up (85% follow-up). Of the 739 patients, 59 patients were converted to THA/resurfacing during the study period and were considered failures (92% survival rate), leaving a total of 680 patients for analysis of 2-year outcome data.

Table I lists the descriptive statistics for our cohort of patients. 64% of the patients were female, average age of 37.6, and underwent surgery an average of 27 months after onset of symptoms. Figure 3 shows the distribution of

Table I. Patient demographics and mechanism of injury

Sex	Male 36% (315/868)	Female 64% (553/868)	
Side of injury	Right 54% (472/868)	Left 46% (396/868)	
Acute injury	Yes 28% (243/868)	No 72% (625/868)	
High energy trauma	Yes 5% (45/868)	No 95% (823/868)	
	Mean	SD	Range
Age at surgery	36.6 years	14.2	13–76 years
Length of symptoms	27.4 months	42	1–360 months
BMI	25.0 kg/m^2	4.8	16.3–43.6 kg/m^2

BMI, body mass index.

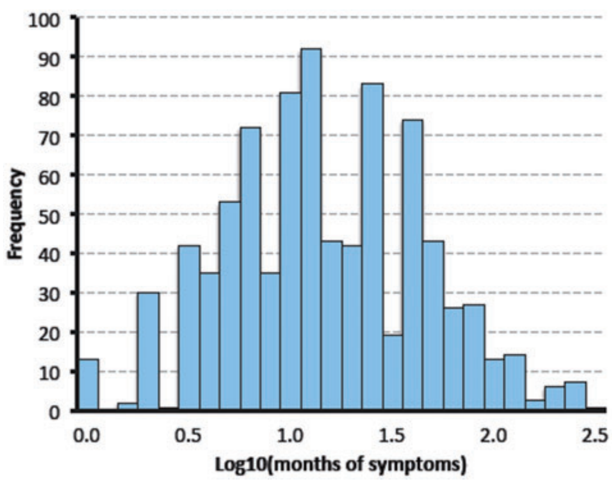

Fig. 3. A histogram distribution plot displaying months of preoperative symptoms in Log_{10} scale is a bell curve.

preoperative duration of symptoms, demonstrating a bell curve when calculated in Log_{10} months of symptoms. 28% of patients had an acute injury and 5% had a high-energy traumatic injury.

Table II shows comparisons between pre- and 2-year postoperative PROs. Overall, patients experienced significant improvements following surgery for all PROs (mHHS 63.0 ± 15.5–82.6 ± 16.7, $P < 0.001$, NAHS 59.8 ± 17.8–81.7 ± 17.5, $P < 0.001$, HOS ADL 65.2 ± 19.2–83.9 ± 18.9, $P < 0.001$, HOS SSS 42.7 ± 24.3–70.9 ± 27.6, $P < 0.001$, VAS 5.9 ± 2.2–2.9 ± 2.4, $P < 0.001$). Figure 4 illustrates the preoperative and postoperative patient reported outcome scores and VAS pain scores with error bars.

Patients requiring conversion to THA were older than those that did not (49.8 ± 9.0 vs. 36.3 ± 14.2, $P < 0.001$). No significant differences were observed for BMI, duration of symptoms or gender between these two groups.

Refer Table III for results of univariate analyses. Length of symptoms had a negative correlation for mHHS, NAHS, HOS-ADL, HOS-SSS, VAS pain and patient satisfaction scores at 2 years follow-up. For every one unit of Log_{10} months of symptoms (13 months), each of the PROs decreased by 5–7 points (mHHS −5.15, $P = 0.009$, NAHS −5.65 $P = 0.0002$, HOS-ADL −5.1 $P = 0.0035$, HOS-SSS −7.59 $P = 0.004$). In addition, increasing age and BMI were also negatively associated with PROs ($P < 0.05$ for mHHS, NAHS, HOS-ADL and HOS-SSS). Increasing age was also associated with increasing postoperative VAS pain scores, $P = 0.0008$. Finally, patients undergoing labral debridement and those whose injuries were from high energy trauma had significantly lower patient reported outcomes, higher VAS pain scores and lower satisfaction scores ($P < 0.05$) compared to the rest of the cohort.

Refer Table IV for results of multivariate analyses. Only age and Log_{10} months of symptoms were independently associated with all four PROs along with pain and satisfaction scores.

DISCUSSION

The major finding in this study is that longer duration of symptoms is negatively associated with 2 year PROs following hip arthroscopy for labral tears. Our results show a decrease in PROs with increased duration of symptoms on a logarithmic scale; for every one unit Log_{10} months of symptoms (13 months), the PROs are expected to drop 5–7 points. After 2 Log_{10} units (169 months), PROs are expected to drop another 5–7 points (Fig. 5).

This is the first study we are aware of specifically reporting a predictive value for outcomes depending upon duration of symptoms prior to surgery. Because the decline in PROs is logarithmic, the greatest decline in PRO's occurs during the initial period after onset of symptoms and as

Table II. Preoperative and postoperative patient reported outcomes and P values

	Preoperative (mean, SD)	*2 year postoperative*	P *value*
mHHS	63.0 ± 15.5	82.6 ± 16.7	<0.0001*
NAHS	59.8 ± 17.8	81.7 ± 17.5	<0.0001*
HOS ADLs	65.2 ± 19.2	83.9 ± 18.2	<0.0001*
HOS SSS	42.7 ± 24.3	70.9 ± 27.6	<0.0001*
VAS Pain	5.9 ± 2.2	2.9 ± 2.4	<0.0001*
Satisfaction	n/a	7.9 ± 2.4	n/a

mHHS, Modified Harris hip score; NAHS, non-arthritic hip score; HOS ADLs, hip outcome score–activities of daily living; HOS SSS, hip outcome score–sport-specific subscale; VAS pain, visual analog scale.
*Significance at $P < 0.05$.

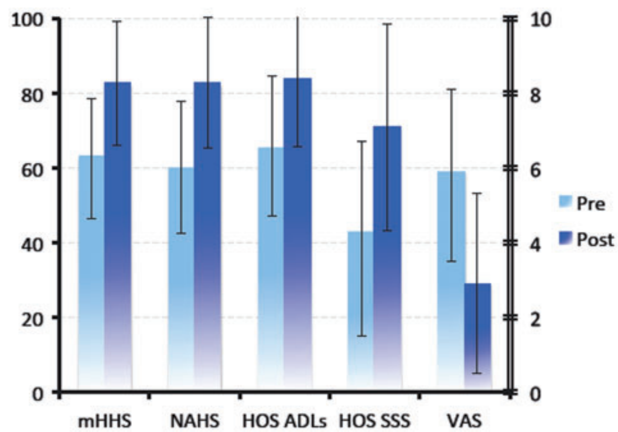

Fig. 4. Bar graph with error bars comparing improvement of patient oriented outcome scores and VAS pain scores from preoperative to postoperative levels.

time goes on, the rate of decline diminishes (Fig. 6). This suggests that a delay in surgical treatment early on after symptom onset may adversely impact patient outcomes following surgery. This by no means suggests that surgeons should abandon conservative measures as first-line treatment of labral tears, however surgeons can use the information found in this study to create a more patient-specific treatment algorithm to maximize treatment outcomes for FAI.

One would logically expect continued chondrolabral injury and dysfunction as duration of symptoms increases. It is important to note, however, that patients with a longer duration of symptoms may have self-selected poorer indications for surgery than those with a shorter duration of symptoms. Patients who are initially managed conservatively (and therefore not offered surgery) may have confounding variables (psychosocial, other anatomic sources of pain) which have raised concerns that surgical treatment may not benefit them. Patients with a shorter duration of symptoms may have met surgical indications earlier due to a perceived better candidacy for surgery.

Another thing to consider when interpreting these results is the minimal clinical important difference (MCID) of the PRO measures. Kemp *et al.* [25] suggest a MCID of 8 points on the mHHS scale, 5 for HOS-ADL and 6 for HOS-SSS. Martin and Phillipon report a MCID of 8, 9 and 6 for mHHS, HOS-ADL and HOS-SSS, respectively [26]. There are no reports of MCID for the NHAS score that we are aware of. A decrease in PRO's of between 5 and 7 points with every Log_{10} months of symptoms is statistically significant but may or may not represent a clinically detectable difference. Regardless, we believe that the results of our study can be used to help guide treatment decisions.

Few studies have directly evaluated the possible correlation between duration of symptoms and outcomes following hip arthroscopy, with conflicting findings reported. Byrd and Jones published on their initial series of 38 patients undergoing hip arthroscopy for a variety of indications, including labral tears, in 2000 [27]. They found that duration of symptoms, especially in older men, was predictive of inferior outcomes following hip arthroscopy. Overall, age was not a predictive factor for inferior outcomes but when stratified by sex, older male patients did worse. However, no specific rates of decline were reported, and not all patients were specifically treated for labral tears. Burnett *et al.* published their findings on the clinical variables of patients presenting with tears of the acetabular labrum [28]. In this group of 66 patients presenting with a variety of underlying diagnoses, the mean time from onset of symptoms to surgery was 21 months. However, no PROs were reported so clinical correlations were not made.

Aprato *et al.* [12] reported their results in 561 patients undergoing hip arthroscopy for FAI, labral tearing or chondral injury. They prospectively followed all patients, and stratified them into three groups based upon preoperative duration of symptoms: Group A (less than 6 months), Group B (6 months to 3 years) and Group C (more than 3 years). Despite similar preoperative mHHS scores between groups, Group A (79) had significantly higher mHHS scores at 3 years postoperatively compared to groups B (75) and C (69), and group B had significantly better scores than Group C.

In 2009, Byrd and Jones published 10-year outcomes for hip arthroscopy in athletes and found no statistically

Table III. Univariate regression analysis of positive predictive factors for improved patient reported outcome scores

variable	*NAHS*			*mHHS*			*HOS-ADLs*			*HOS-SSS*			*VAS pain*			*Satisfaction*		
	Rate	*SE*	P	*Rate*	*SE*	P	*Rate*	*SE*	P	*Rate*	*SE*	P	*Rate*	*SE*	P	*Rate*	*SE*	P
Log10 months of symptoms	−5.65	1.51	0.0002*	−5.15	1.55	0.0009*	−5.10	1.75	0.0035	−7.59	2.64	0.0040	0.852	0.195	<0.0001*	−0.683	0.15	<0.0001*
Age at surgery	−0.29	0.051	<0.0001*	−0.24	0.052	0.0000*	−0.34	0.059	<0.0001*	−0.398	0.089	<0.0001*	0.023	0.007	0.0008*	−0.0059	0.005	0.2815
BMI (kg/m^2)	−0.65	0.154	<0.0001*	−0.47	0.157	0.0026*	−0.88	0.174	<0.0001*	−0.824	0.267	0.0020*	0.024	0.020	0.2340	0.003	0.016	0.8730
Female Sex	1.45	1.577	0.3589	1.36	1.615	0.4000	2.676	1.809	0.1390	2.94	2.727	0.2816	−0.110	0.206	0.5945	0.238	0.164	0.1469
Acute injury	−0.01	0.007	0.2792	−0.01	0.008	0.2138	−0.01	0.008	0.2278	−0.016	0.013	0.2199	0.002	0.001	0.1037	−0.001	0.001	0.4248
High energy trauma	−11.91	3.546	0.0008*	−8.61	3.661	0.0186*	−13.9	4.094	0.0007*	−17.69	6.342	0.0053*	1.324	0.476	0.0056*	−0.304	0.382	0.4264
Pre op mHHS	0.34	0.046	<0.0001*	0.311	0.047	<0.0001*	0.431	0.052	<0.0001*	0.514	0.080	<0.0001*	−0.023	0.006	0.0002*	−0.002	0.005	0.6862
Pre op NAHS	0.36	0.039	<0.0001*	0.318	0.041	<0.0001*	0.449	0.044	<0.0001*	0.504	0.069	<0.0001*	−0.026	0.005	0.0000*	0.001	0.004	0.8608
Pre op HOS ADLs	0.32	0.036	<0.0001*	0.289	0.038	<0.0001*	0.409	0.041	<0.0001*	0.461	0.065	<0.0001*	−0.019	0.005	0.0002*	−0.002	0.004	0.6275
Pre op HOS SSS	0.18	0.030	<0.0001*	0.153	0.031	<0.0001*	0.247	0.034	<0.0001*	0.323	0.052	<0.0001*	−0.004	0.004	0.3011	−0.004	0.003	0.2078
Pre op VAS	−1.09	0.337	0.0013*	−0.927	0.346	0.0075*	−1.065	0.389	0.0062*	−0.438	0.587	0.4559	0.166	0.044	0.0002*	0.016	0.035	0.6507
Labral base refixation	6.14	2.18	0.0048*	5.52	2.21	0.0125*	7.59	2.48	0.0022*	10.45	3.76	0.0055*	−0.542	0.287	0.0591	0.507	0.227	0.0255*
Labral stitch	4.93	1.66	0.0030*	6.27	1.70	0.0002*	6.42	1.89	0.0007*	7.53	2.86	0.0084*	−0.418	0.220	0.0577	0.543	0.174	0.0019*
Labral combined repair/debridement	3.92	5.80	0.4991	2.47	5.64	0.6612	1.23	6.44	0.8483	9.13	9.78	0.3505	−0.816	0.746	0.2746	0.066	0.590	0.9107
labral resection	5.56	4.38	0.2040	8.74	4.61	0.0583	5.02	4.95	0.3110	11.80	7.57	0.1191	0.021	0.586	0.9710	0.791	0.464	0.0883
labral reconstruction	6.65	6.57	0.3119	11.43	6.74	0.0897	3.77	7.35	0.6084	16.30	11.13	0.1430	−0.637	0.857	0.4571	0.766	0.677	0.2588
labral debridement	−4.44	1.68	0.0082*	−5.71	1.710	0.0008*	−5.31	1.93	0.0059*	−5.83	2.908	0.0451*	0.472	0.222	0.0338*	−0.475	0.176	0.0071*
Capsular closure	2.46	1.52	0.1066	1.51	1.560	0.3318	4.45	1.75	0.0110*	3.18	2.632	0.2267	−0.288	0.199	0.1473	0.021	0.159	0.8973
Capsular plication	2.15	3.69	0.5608	1.26	3.778	0.7392	1.23	4.22	0.7701	−4.17	6.336	0.5107	0.110	0.479	0.8187	−0.161	0.383	0.6750
Partial capsulotomy	5.24	4.88	0.2824	3.04	4.923	0.5371	5.36	5.50	0.3303	15.30	8.454	0.0704	0.408	0.625	0.5142	0.307	0.501	0.5394

mHHS, Modified Harris hip score; NAHS, non-arthritic hip score; HOS ADLs, hip outcome score–activities of daily living; HOS SSS, hip outcome score–sport-specific subscale; VAS pain, visual analog scale.
*Significance at $P < 0.05$.

Table IV. Multivariate regression analysis of positive predictive factors for improved patient reported outcomes after hip arthroscopy

variable	*NAHS*			*mHHS*			*HOS-ADLs*			*HOS-SSS*			*VAS pain*			*Satisfaction*		
	rate	*S.E.*	*p value*	*rate*	*S.E.*	*p value*	*rate*	*S.E.*	*p value*	*rate*	*S.E.*	*p value*	*rate*	*S.E.*	*p value*	*rate*	*S.E.*	*p value*
Intercept	74.74	3.56	<0.0001	73.40	4.07	<0.0001	82.68	5.59	<0.0001	36.53	9.86	0.0002	1.86	0.70	0.0078	9.00	0.20	<0.0001
Log_{10} months of symptoms	−4.60	1.42	0.0012	−4.31	1.475	0.0035	−4.10	1.58	0.009	−5.80	2.50	0.0205	0.716	0.19	0.0002	−0.67	0.15	<0.0001
Age at surgery	−0.20	0.05	0.0000	−0.18	0.056	0.0012	−0.17	0.058	0.0030	−0.27	0.09	0.0023	0.016	0.007	0.0155			
BMI (kg/m^2)							−0.41	0.171	0.0167									
Sex				3.27	1.608	0.0420												
Acute injury																		
High energy trauma	−6.57	3.29	0.0457				−7.61	3.716	0.0406				0.95	0.46	0.0387			
Preop mHHS										0.28	0.12	0.0238						
Preop NAHS	0.200	0.078	0.0093	0.170	0.081	0.0355	0.182	0.087	0.0365	0.40	0.11	0.0003	−0.03	0.008	0.0001			
Preop HOS ADLs				0.149	0.074	0.0446	0.218	0.080	0.0062									
Preop HOS SSS													0.016	0.005	0.0043			
Preop VAS										2.03	0.65	0.0017	0.097	0.048	0.0430			
Labral base refixation																		
Labral stitch				3.95	1.49	0.0080										0.312	0.15	0.0412
Labral combined repair/debridement																		
Labral resection																		
Labral reconstruction																		
Labral debridement																		
Capsular closure				−3.61	1.72	0.0353												
Capsular plication																		
Partial capsulotomy	8.85	4.43	0.0456							22.04	8.10	0.0065						

mHHS, Modified Harris hip score; NAHS, non-arthritic hip score; HOS ADLs, hip outcome score–activities of daily living; HOS SSS, hip outcome score–sport-specific subscale; VAS Pain, visual analog scale. Only significant values with $P < 0.05$ displayed.

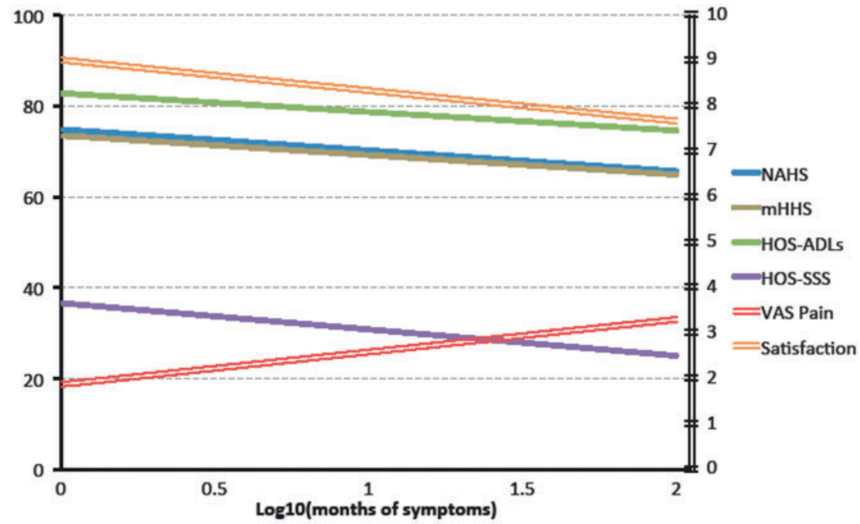

Fig. 5. Plot of the patient reported outcome scores versus the Log10 of months of preoperative symptoms demonstrating the negative slope for all patient reported outcome scores and positive slope for VAS pain scores with longer preoperative symptom duration.

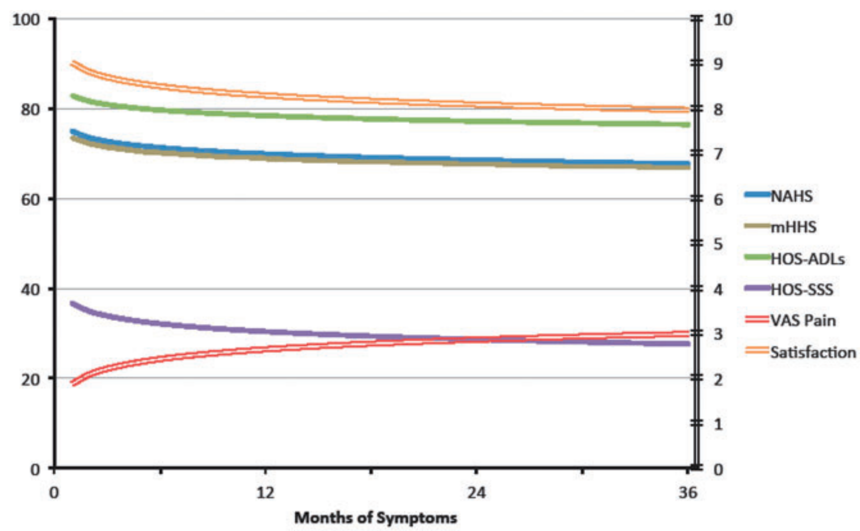

Fig. 6. Plot of the patient reported outcome scores versus the months of preoperative symptoms demonstrating logarithmic worsening of outcome scores and VAS pain scores with increasing preoperative symptom duration.

significant correlations between length of symptoms and outcomes, although they did comment that based on the limited number of patients (15) the study was underpowered to detect differences [29]. In contrast, Kamath *et al.* found that longer duration of symptoms led to improved outcomes following hip arthroscopy [13]. They retrospectively reported on 52 consecutive patients undergoing hip arthroscopy for labral tears. During multivariate analysis, left-sided surgery, higher preoperative activity level and duration of symptoms greater than 18 months were found to be positive predictors of good to excellent results. Clearly, predicting outcomes from hip arthroscopy is complex and cannot simply be based on duration of symptoms in light of the conflicting data.

Despite recent publications suggesting age does not preclude good to excellent outcomes following hip arthroscopy, our study showed that older age negatively correlated with outcomes [30–32]. The overall rate was roughly −0.2 PRO points/year, or for every 5 years in age after controlling for all other variables, the PRO would be expected to be 1 point lower. This small but significant difference may be due to unrecognized chondral damage, as other variables including visible chondral damage grade were controlled for.

We also found that patients with a high-energy acute traumatic injury had significantly lower PRO scores than their counterparts. These patients had PRO scores roughly 12 points lower controlling for other variables. Other studies have reported similar findings as our study [13]. In contrast, Byrd and Jones found that patients with traumatic injuries had greater improvements following hip arthroscopy than patients with an insidious onset of symptoms. In addition, patients with an atraumatic acute onset of symptoms actually had lower postoperative scores [27].

Patients with labral debridement did worse than patient receiving labral repairs in our study group. Overall, patients with labral debridement had PRO scores five points lower after controlling for other variables. This is consistent with several other studies [6, 33]. This intuitively makes sense as debridement alone may disrupt the biomechanical function of the labrum. Anatomic repair is the preferred approach in our practice when possible.

Strengths

This is the first study specifically reporting a predictive value for outcomes depending upon length of symptoms. Also, it is a large group of patients prospectively followed for a specific condition with a high percentage of follow-up.

Limitations

This study has limitations. It is a retrospective study without a control group, which precludes the ability to compare operative versus non-operative treatment for labral tears. This is a short-term follow-up study, so it is unknown whether the differences in outcome persist in the long-term or if they normalize over time. Because symptom duration was calculated based off of a patient reported intake form, recall bias is another potential limitation. There is also concern for selection bias because patients with a longer duration of symptoms may have self-selected poorer indications for surgery than those with a shorter duration of symptoms, as mentioned above. Another limitation of our study is its heterogeneity. We included labral repairs, labral debridements, labral reconstructions, femoroplasty, acetabuloplasty, psoas recession, capsular repair and many of these in combination, which adds heterogeneity to the study. Finally, data regarding the degree of chondrolabral injury was not available for this study and therefore its effect on outcomes and symptom duration could not be assessed.

Conclusions

Our study demonstrates that clinical and PRO scores were negatively associated with increasing duration of symptoms prior to hip arthroscopy for treatment of labral tears. Although this implies that delay in treatment may adversely affect outcome, conservative treatment remains the gold standard, first line of treatment. Surgeons should incorporate this information into their treatment algorithm to maximize patient outcomes following treatment for labral tears.

ACKNOWLEDGEMENT

The authors thank Dr Jeffrey Gornbein for the statistical analysis.

FUNDING

None.

CONFLICT OF INTEREST STATEMENT

Dr. Domb reports grants and personal fees from Arthrex, grants from Breg, grants from ATL, grants and personal fees from Pacira, grants and personal fees from Stryker, other fees from Orthomerica, other fees from DJO Global, personal fees from Amplitude, outside the submitted work; and Dr Domb is a board member for American Hip Institue, which funds research and is the Institue where our studies are performed. Dr Domb is also a board member at the AANA Learning Center Committee. Dr Domb is on the editorial board for the American Journal of Sports Medicine, Arthroscopy, Journal of Bone and Joint Surgery and Journal of Arthroplasty.

Dr. Dierckman is a consultant for Depuy Mitek and is a paid presenter and speaker.

REFERENCES

1. Boykin RE, Patterson D, Briggs KK *et al*. Results of arthroscopic labral reconstruction of the hip in elite athletes. *Am J Sports Med* 2013; **41**: 2296–301.
2. Ferguson SJ, Bryant JT, Ganz R *et al*. The acetabular labrum seal: a poroelastic finite element model. *Clin Biomech* 2000; **15**: 463–8.
3. Ferguson SJ, Bryant JT, Ganz R *et al*. An in vitro investigation of the acetabular labral seal in hip joint mechanics. *J Biomech* 2003; **36**: 171–8.
4. Ferguson SJ, Bryant JT, Ganz R *et al*. The influence of the acetabular labrum on hip joint cartilage consolidation: a poroelastic finite element model. *J Biomech* 2000; **33**: 953–60.
5. Ferguson SJ, Bryant JT, Ito K. The material properties of the bovine acetabular labrum. *J Orthop Res* 2001; **19**: 887–96.
6. Larson CM, Giveans MR, Stone RM. Arthroscopic debridement versus refixation of the acetabular labrum associated with

femoroacetabular impingement: mean 3.5-year follow-up. *Am J Sports Med* 2012; **40**: 1015–21.
7. Kelly BT, Weiland DE, Schenker ML *et al*. Arthroscopic labral repair in the hip: surgical technique and review of the literature. *Arthroscopy* 2005; **21**: 1496–504.
8. Groh MM, Herrera J. A comprehensive review of hip labral tears. *Curr Rev Musculoskelet Med* 2009; **2**: 105–17.
9. Sawyer GA, Briggs KK, Dornan GJ *et al*. Clinical outcomes after arthroscopic hip labral repair using looped versus pierced suture techniques. *Am J Sports Med* 2015; **43**: 1683–8.
10. Jackson TJ, Hammarstedt JE, Vemula SP *et al*. Acetabular labral base repair versus circumferential suture repair: a matched-paired comparison of clinical outcomes. *Arthroscopy* 2015; **31**: 1716–21.
11. Byrd JW, Jones KS. Primary repair of the acetabular labrum: outcomes with 2 years' follow-up. *Arthroscopy* 2014; **30**: 588–92.
12. Aprato A, Jayasekera N, Villar R. Timing in hip arthroscopy: does surgical timing change clinical results? *Int Orthop* 2012; **36**: 2231–4.
13. Kamath AF, Componovo R, Baldwin K *et al*. Hip arthroscopy for labral tears: review of clinical outcomes with 4.8-year mean follow-up. *Am J Sports Med* 2009; **37**: 1721–7.
14. Tönnis D, Heinecke A. Acetabular and femoral anteversion: relationship with osteoarthritis of the hip. *J Bone Joint Surg Am* 1999; **81**: 1747–70.
15. Wiberg G. Shelf operation in congenital dysplasia of the acetabulum and in subluxation and dislocation of the hip. *J Bone Joint Surg Am* 1953; **35**: 65–80.
16. Jessel RH, Zurakowski D, Zilkens C *et al*. Radiographic and patient factors associated with pre-radiographic osteoarthritis in hip dysplasia. *J Bone Joint Surg Am* 2009; **91**: 1120–9.
17. Werner CM, Copeland CE, Ruckstuhl T *et al*. Radiographic markers of acetabular retroversion: correlation of the cross-over sign, ischial spine sign and posterior wall sign. *Acta Orthop Belg* 2010; **76**: 166–73.
18. Nötzli HP, Wyss TF, Stoecklin CH *et al*. The contour of the femoral head-neck junction as a predictor for the risk of anterior impingement. *J Bone Joint Surg Br* 2002; **84**: 556–60.
19. Meyer DC, Beck M, Ellis T *et al*. Comparison of six radiographic projections to assess femoral head/neck asphericity. *Clin Orthop Relat Res* 2006; **445**: 181–5.
20. Domb BG, Hanypsiak B, Botser I. Labral penetration rate in a consecutive series of 300 hip arthroscopies. *Am J Sports Med* 2012; **40**: 864–9.
21. Crawford K, Philippon MJ, Sekiya JK *et al*. Microfracture of the hip in athletes. *Clin Sports Med* 2006; **25**: 327–35.
22. Domb BG, Shindle MK, McArthur B *et al*. Iliopsoas impingement: a newly identified cause of labral pathology in the hip. *HSS J* 2011; **7**: 145–50.
23. Fry R, Domb BG. Labral base refixation in the hip: rationale and technique for an anatomic approach to labral repair. *Arthroscopy* 2010; **26**: S81–9.
24. Domb BG, El Bitar YF, Stake CE *et al*. Arthroscopic labral reconstruction is superior to segmental resection for irreparable labral tears in the hip: a matched-pair controlled study with minimum 2-year follow-up. *Am J Sports Med* 2014; **42**: 122–30.
25. Kemp JL, Collins NJ, Roos EM *et al*. Psychometric properties of patient-reported outcome measures for hip arthroscopic surgery. *Am J Sports Med* 2013; **41**: 2065–73.
26. Martin RL, Phillipon MJ. Evidence of validity for the hip outcome score in hip arthroscopy. *Arthroscopy* 2007; **23**: 822–6.
27. Byrd JW, Jones KS. Prospective analysis of hip arthroscopy with 2-year follow-up. *Arthroscopy* 2000; **16**: 578–87.
28. Burnett RS, Della Rocca GJ, Prather H *et al*. Clinical presentation of patients with tears of the acetabular labrum. *J Bone Joint Surg Am* 2006; **88**: 1448–57.
29. Byrd JW, Jones KS. Hip arthroscopy in athletes: 10-year follow-up. *Am J Sports Med* 2009; **37**: 2140–3.
30. Redmond JM, Gupta A, Cregar WM *et al*. Arthroscopic treatment of labral tears in patients aged 60 years or older. *Arthroscopy* 2015; **31**: 1921–7.
31. Domb BG, Linder D, Finley Z *et al*. Outcomes of hip arthroscopy in patients aged 50 years or older compared with a matched-pair control of patients aged 30 years or younger. *Arthroscopy* 2015; **31**: 231–8.
32. Ben Tov T, Amar E, Shapira A *et al*. Clinical and functional outcome after acetabular labral repair in patients aged older than 50 years. *Arthroscopy* 2014; **30**: 305–10.
33. Tibor LM, Leunig M. Labral resection or preservation during fai treatment? a systematic review. *HSS J* 2012; **8**: 225–9.