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CASE REPORT

REHABILITATION AFTER HIP ARTHROSCOPY AND LABRAL REPAIR IN A HIGH SCHOOL FOOTBALL ATHLETE: A 3.6 YEAR FOLLOW-UP WITH INSIGHT INTO POTENTIAL RISK FACTORS

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ABSTRACT

Background: Hip arthroscopy is a common surgical technique for the correction of intraarticular pathology. While surgical success is often determined by anatomical correction, post-operative rehabilitation serves an essential role in restoring pre-morbid activity levels. A paucity of long-term post-operative rehabilitation outcomes exists in the literature lending uncertainty to the long-standing efficacy of interventions and associated risk for future injury

Case Description: This case report describes the progress of a male subject 3.6 years after left hip arthroscopy with labral repair. Detailed clinical measures and insight into potential risk factors are presented as a follow-up to a previously published case report.

Outcome: A 3.6-year follow-up assessment revealed potential risk factors that may have predisposed the subject to future pathology. The most profound finding was the subject's complaint of contralateral right hip pain and examination findings suggesting intraarticular pathology. His left surgical hip presented with no reported problems or significant findings. The examination also revealed an anterior tilted pelvis, muscle length deficits, and hip muscle weakness which may have contributed to his right hip pain or may be risk factors for future pathology in both hips. It appeared that these impairments affected his gait and performance on functional tests.

Discussion: This case report describes the 3.6 year follow-up for a young adult male subject after unilateral left hip arthroscopy and acetabular labral repair. The re-examination findings and risk factors identified at the follow-up may provide insight into the need for long-term surveillance among post-surgical individuals. Detailed reporting of the long-term effects of a post-operative program after hip arthroscopy is non-existent in the literature and the current findings suggest the potential need for mitigating risk in the non-surgical hip. Future longitudinal studies are needed to develop a consensus on the best interventions for these patients.

Keywords: Femoral acetabular impingement; hip; impingement

Level of Evidence: 4-Case Report

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BACKGROUND

Hip arthroscopy has become a common surgical technique for correction of hip intraarticular pathology. Hip arthroscopic procedures have increased in the United States between 2004 and 2009 with a reported incidence rate of 1.2 cases per 10,000 in 2004 to 5.58 cases per 10,000 in 2009.[1] The rate of surgical complications remains low with a reported 0.58% incidence and a reoperation rate of 6.3%, with the most common reason being a conversion to total hip arthroplasty.[2] The surgical technique may include single or combination of procedures such as: correction for femoral acetabular impingement (FAI), labral debridement or repair, chondroplasty, osteoplasty, microfracture, synovectomy, repair of the ligamentum teres, treatment for capsular hyperlaxity, and loose body removal.[3]

Post-operative rehabilitation is an essential component for helping patients return to pre-morbid athletic activity after surgery. Often, the patient will follow a structured rehabilitation program based upon the operative procedures and surgeon specific guidelines. Several authors[4-9] have presented a structured intervention program in clinical commentaries but a consensus on the optimal evidence based post-operative rehabilitation program does not exist. Moreover, post-operative management has not been investigated in a comparison based trial suggesting there is little basis for the superiority of one approach versus another. This paucity of evidence may be due to procedural variability given the potential for numerous procedures that may be performed during an arthroscopic surgery. A recent systematic review appraised the literature investigating postoperative programs after hip arthroscopy and reported that post-operative programs are under investigated with only case reports (level 4 evidence) available to guide clinical practice.[10] There seems to be a lack of long term follow-up among the evidence. There was only one manuscript that reported a follow-up greater than one year.[10] Bizzini et al[11] followed patients for an average of 2.7 years post-operatively and reported the time period when the individuals regained symmetrical range of motion (ROM), pre-injury level of hip and core strength, and return to sport. Unfortunately, the authors in the aforementioned study did not provide any data for these clinical measures. These methods of reporting are consistent with the literature reporting hip arthroscopic post-operative outcomes, which often provide little details of the rehabilitation program and specific outcome measures.[3,12,13] This leaves a gap in current understanding of the long-standing effects of post-operative rehabilitation programs and which interventions influence recovery. More detailed longitudinal reporting of the effects of post-operative rehabilitation would provide clinicians with the necessary information to determine the best immediate and long-term strategies for their patients.

Along with the need for reporting the long-term effects of post-operative rehabilitation, a good long-term prognosis would seem to be dependent upon clinicians having the necessary information to recognize, identify, and address apparent risk factors for future or recurring pathology. Several authors have reported potential risk factors which include radiographic findings,[14,15] postural deviations,[16-19] pelvic positions,[19,20] gait kinematics,[21-23] muscle length deficits,[22] and poor hip muscle strength.[18,24-26] Also, several authors have found a correlation between FAI and lumbopelvic issues such as osteitis pubis,[27,28] athletic pubalgia,[29] and lumbosacral issues.[30] It has been suggested that these concomitant injuries are caused by stresses across the lumbopelvic region due to compensatory movements from mechanical hip pain.[30]

To date, there is little epidemiological data regarding the risks for future or recurrence of FAI after surgery. One recent study examined the regrowth rate of the femoral cam lesion after osteoplasty for FAI. Gupta et al[31] conducted an average two-year follow-up on a group of 47 patients (N = 28 males, 19 females). The authors found no recurrence of CAM deformity based upon pre and post-surgical radiographic examination. However, one cannot surmise that a two-year follow up would provide definitive long-term insight beyond this timeline.

For the clinician, recognizing the connection between potential risk factors and the recurrence rates for intra-articular pathology would seemingly offer a prognostic benefit to patients. Current research is emerging and a clear consensus of how to prevent future or recurring FAI remains under investigation. Despite the growing popularity of hip

arthroscopy, there is a disparity between the surgical procedure and consensus for the optimal post-surgical rehabilitation program. In 2012, the authors published a case-report[32] detailing a four-phase rehabilitation program for an 18-year-old male high school athlete who underwent arthroscopic surgery for a left hip mixed cam-pincer FAI with an anterior superior acetabular labral tear. The aforementioned case report had, both one and four month follow-up reports with detailed clinical measures.[32] The purpose of this case report is to report the progress of the subject at a 3.6 year follow-up with details of the re-examination and insight into potential risk factors.

CASE DESCRIPTION

A subject that was initially treated in 2011, following a left hip arthroscopy, was seen via direct access for a recent onset of right hip pain. Reexamination was performed by the same physical therapist (SWC) in 2014, approximately 3.6 years after his 2011 arthroscopic left hip surgery. Details from the initial case report[32] are reviewed and new findings are presented from the current examination followed by a discussion on the current findings and insight into risk potential.

Patient History and Treatment (2011)

At the time of the initial examination, the subject was a healthy 18-year-old male high school athlete with a mixed endomorphic-mesomorphic build (body mass-92.53 kg, height- 182.9 cm, body mass index-27.7kg/m2) who underwent arthroscopic surgery for a left hip mixed FAI with an anterior superior labral tear in March 2011.[32] The subject participated in high school American football (at the free-safety position) and reported an insidious onset of left hip and groin pain for one year prior to formal diagnosis. Diagnosis was confirmed by magnetic resonance arthrogram (MRA) (3Tesla from Philips©,Andover, MA) which revealed a left mixed cam-pincer FAI with an anterosuperior labral tear. The subject's symptoms were recalcitrant to physical therapy, activity modification, and medical management.[32] The surgical intervention included an acetabular and femoral head osteoplasty & chondroplasty, a capsular synovectomy, and an anterior superior labral repair via two arthroscopic portals. The subject's primary goals were to return to pain-free physical activity and begin college football in the fall.[32] The patient underwent a comprehensive initial examination and four-phase treatment program that is detailed in an earlier publication.[32]

Discharge (2011)

The subject met all goals and was discharged after completing 16 weeks of physical therapy. The subject reported 0/10 pain on the numeric pain rating scale (NPRS) with activities of daily living, weight training, and sports activity (e.g. jogging, football drills).[32] The Flexion-Adduction-Internal Rotation (FADIR) test was also negative for signs of hip impingement in both hips (Table 1).[33] The subject had active and passive pain-free hip ROM in all motions. Manual muscle testing of both hips and lower extremities were graded at a 5/5 (normal) for all muscle groups tested (Table 2). Muscle length testing using the Ober test, 90/90 hamstring test, Ely test for rectus femoris length, and Thomas test was normal except for mild left hip flexor tightness confirmed with the Thomas test. The subject presented with a normal gait and no visible lower kinetic chain deviations during single leg and multidirectional activity demonstrated by little to no compensatory movements at the hip, knee, and ankle (Table 1). Shortly after discharge, the subject was cleared by his surgeon to begin advanced sports specific and agility training in preparation for the next football season at the collegiate level.[32]

One and Four Month Post Discharge Follow-Up

At the one month re-examination, the subject reported 0/10 pain with sports specific training, weight-lifting, agility training, and jogging. The FADIR test was also negative for signs of hip impingement.[32] Bilateral active and passive hip ROM in all motions was still normal.[32] The subject did present with a left positive 90/90 hamstring and Thomas test that revealed decreased muscle length (Table 1). Manual muscle testing of both hips, knees, and ankles was graded at a 5/5 (normal) (Table 2). The subject still presented with a normal bilateral gait pattern and no visible lower kinetic chain deviations with bilateral, single leg, and multidirectional movements. The subject was advised of the decreased muscle length in the left hip region and educated on the need for flexibility activities.

At the four month follow-up, the subject had reduced his body mass to 83.91 kg and presented with an

Table 1. *Clinical Measures*

Clinical Measures	Discharge		1 month follow-up		4 month follow-up		3.6 year follow-up	
	Right	Left	Right	Left	Right	Left	Right	Left
NPRS	0/10	0/10	0/10	0/10	0/10	0/10	3/10	0/10
FADIR	Neg	Neg	Neg	Neg	Neg	Neg	Pos	Neg
FABER							Pos	Neg
Ober Test	Neg	Neg	Neg	Neg	Neg	Neg	Neg	Neg
90/90 Hamstring Test	Neg	Neg	Neg	Pos	Neg	Neg	Pos	Pos
Ely Test	Neg	Neg	Neg	Neg	Neg	Neg	Pos	Pos
Thomas Test	Neg	Pos	Neg	Pos	Neg	Neg	Pos	Pos
Gait Assessment	Good	Good	Good	Good	Good	Good	Poor	Good
Single Leg Squat	Good	Good	Good	Good	Good	Good	Poor	Fair
Bilateral Squat	Good	Good	Good	Good	Good	Good	Poor	Poor
Multidirectional Toe Touching	Good	Good	Good	Good	Good	Good	Poor	Fair
Single Leg Balance (30 sec)	Good	Good	Good	Good	Good	Good	Good	Good

Neg= negative; Pos=positive; gait and functional testing graded as good, fair, and poor

Table 2. *Manual Muscle Testing*

Muscle Groups Tested	Discharge		1 month follow-up		4 month follow-up		3.6 year follow-up	
	Right	Left	Right	Left	Right	Left	Right	Left
Hip flexors	5/5	5/5	5/5	5/5	5/5	5/5	4/5	4+/5
Hip extensors	5/5	5/5	5/5	5/5	5/5	5/5	4/5	4+/5
Hip abductors	5/5	5/5	5/5	5/5	5/5	5/5	4/5	4+/5
Hip adductors	5/5	55	5/5	5/5	5/5	5/5	5/5	5/5
Hip external rotators	5/5	5/5	5/5	5/5	5/5	5/5	4/5	4+/5
Hip internal rotators	5/5	5/5	5/5	5/5	5/5	5/5	4/5	4+/5
Knee extensors	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5
Knee flexors	5/5	5/5	5/5	5/5	5/5	5/5	4+/5	4+/5
Ankle Dorsiflexors	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5
Ankle Plantarflexors	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5
Ankle inverters	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5
Ankle Everters	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5

observable mesomorphic build. The subject had continued full pain-free (0/10) unrestricted activity that included running, power lifting, and football training at college. The re-examination revealed a negative FADIR test and normal bilateral active and passive hip ROM in all motions.[32] Bilateral muscle length was normal. Manual muscle testing of both hips, knees, and ankles was graded at a 5/5 (normal) (Table 2). The subject continued to present with a normal gait pattern and no observable lower kinetic chain deviations with bilateral, single leg, and multi-directional movements (Table 1).[32]

Outcomes: Three-Year Follow-up

Subject History

A re-examination was conducted approximately 3.6 years after the subject's left hip arthroscopic surgery due to a recent onset of right hip pain after activity. The subject presented as a healthy 21-year-old with a mesomorphic build (body mass-86.18 kg, height- 182.9 cm, body mass index-25.8). The subject had finished his collegiate football experience in 2013 and was still a student finishing his degree coursework. The subject reported participating in

weight training, jogging, and recreational sports (e.g. basketball) with 0/10 pain in his left hip. However; the subject did report a 3/10 pain in his right hip with the activities noted above after 30 minutes of participation. Pain was described as a "deep right groin pain" that was similar to his left hip with an insidious onset over the prior three months with no known mechanism. The pain would resolve with rest. Mechanical hip symptoms such as "clicking" and "popping" were also reported during physical activity or twisting movements. The subject was unable to reproduce the symptoms when asked during the examination. A systems review and neurovascular screen were inconclusive for medical red flags in both lower extremities as presentation was entirely mechanical.

Re-Examination

A static standing posture screen revealed a moderate sway back (Figure 1) with an observable anterior tilted pelvis which was a new finding since initial episode of care in 2011. Lower extremity ROM was measured using a standard goniometer.[34] Normal bilateral active and passive hip ROM was observed except for right hip flexion (100˚) and internal rotation (30˚). The subject demonstrated a guarding response at the end range of those motions. Muscle length was assessed using the Ober test,[35] 90/90 hamstring test,[36] Ely test for rectus femoris length,[37-39] and Thomas test [35,40] for one-joint hip flexors. The subject presented with a bilateral positive 90/90 hamstring, Ely, and Thomas tests revealing decreased muscle length. Manual muscle testing (without dynamometer) revealed bilateral weakness in the hip flexors, extensors, abductors, internal rotators, external rotators, and knee flexors (Table 2).

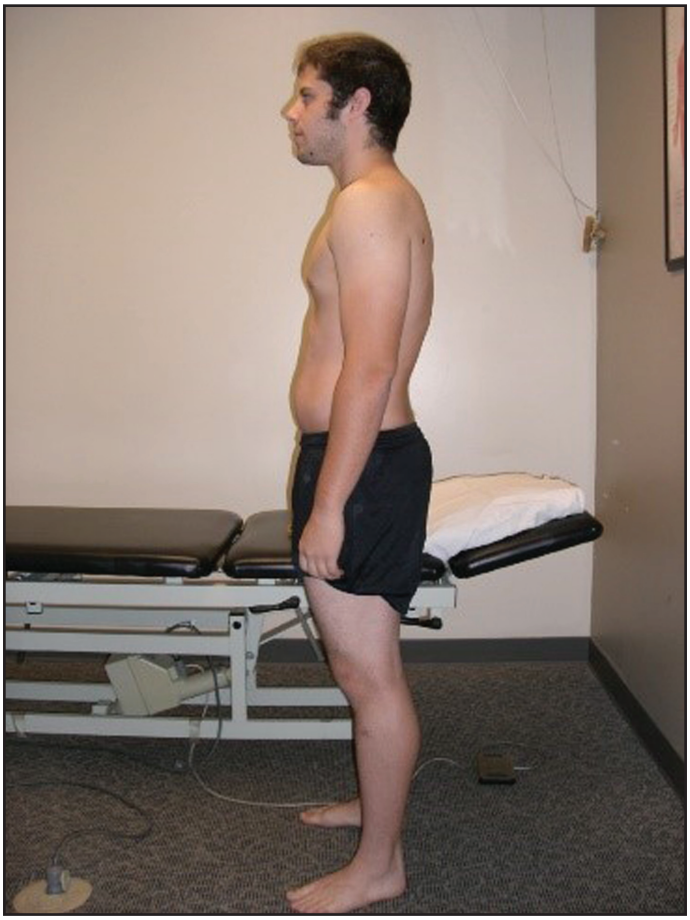

Figure 1. *Sway back posture displayed by the subject.*

Observational gait assessment revealed no major sagittal or frontal plane deviations on the left. The right lower extremity demonstrated a shortened stride slowing the patient's walking cadence. Functional testing identified visible deviations through the lower kinetic chain in both lower extremities. During repeated bilateral squats, the subject limited the descent angle to approximately 80 to 90˚ of knee flexion due to pain (3/10) in the right anterior hip region. During the single leg squat, the subject's right leg demonstrated a valgus collapse between approximately 45 and 60˚ of knee flexion with a reported 3/10 hip pain as the knee angle reached approximately 80˚ where the subject stopped. The left knee also demonstrated a valgus collapse between approximately 60 to 90˚ with no pain. During multidirectional toe touching, the subject demonstrated increased trunk sway and valgus deviation for both legs in the frontal plane and oblique angles (Table 1). The subject was only able to squat to a depth of 45 to 60˚ on the right leg and 90˚ with the left. Special testing was conducted last due to the new complaints reported by the subject. The examiner conducted the FADIR (Figure 2) and flexion-abduction-external rotation (FABER) test to assess for a suspected intra-articular hip pathology.[33,41] Both tests were positive on the right hip reproducing the subject's concordant pain and were negative on the left hip.

Assessment and Decision-Making

The re-examination revealed decreased active and passive ROM in the right hip, bilateral muscle length

Figure 2. *FADIR test.*

deficits, bilateral hip muscle weakness, anterior tilted pelvis, and a shortened stride length on the right lower extremity during gait. The examination also revealed bilateral lower kinetic chain deviations during functional testing and positive right hip impingement tests. The subject was referred to an orthopedic surgeon for further examination of the right hip with restricted exercise for the right hip until cleared. Pending the outcomes, the subject was to be scheduled for physical therapy to address the newfound impairments once a final diagnosis had been determined by the orthopedic surgeon.

DISCUSSION

This is the first long-term post-rehabilitation follow up case report for a male athlete who underwent a left hip arthroscopy and labral repair. There is a lack of longitudinal data regarding outcomes of post-operative rehabilitation programs. This case report detailed re-examination findings at a follow-up period of approximately 3.6 years which revealed interesting findings that may be considered risk factors for future intra-articular pathology.

Contralateral Hip Pathology

The most profound finding was the subject's reported right hip pain and positive examination findings suggesting the presence of an intra-articular pathology such as FAI. Klingenstein et al[14] found that younger males with hip radiographic finding of a higher alpha angle and acetabular anteversion may be at a significant risk for bilateral FAI. Even though the subject was symptomatic in one hip, he may have been predisposed to bilateral deformity. Macguffin et al[15] found that the contralateral hip may be predisposed to cartilage degradation in individuals with bilateral CAM deformity who have unilateral hip pain. These findings may not have been identifiable at the time of his initial diagnosis several years prior. The subject has since been referred back to the surgeon for examination of the right hip which may provide more insight into these contralateral hip findings.

Postural Deviations

The subject's anterior tilted pelvis may be a potential risk factor. Ross et al[19] found that anterior pelvic tilting resulted in significant acetabular retroversion and a decrease in femoral internal rotation in 90° of flexion and 15° of adduction. The authors' concluded that an anterior tilted pelvis was a predictor for earlier occurrences of FAI due to the influence the position has on the functional orientation of the acetabulum. Ida et al[42] also found that subjects with both cam-type FAI and actetabular dysplasia assumed a greater anterior tilted pelvis when in standing. The authors concluded that these morphological issues may induce secondary symptoms in these patients.[42] Clinician's should be aware of the assumed pelvic positions, such an anterior pelvic tilting, in patients with FAI due to the possible implications it may have on the patient's symptoms and risk for future pathology.

Gait Deviations

The re-examination revealed muscle length deficits and bilateral hip weakness which may have affected the subject's gait and could be potential risk factors or influence the progression of an existing intra-articular hip pathology. Kennedy et al[22] observed gait differences in hip abduction, sagittal and frontal plane hip ROM in subjects with FAI when compared to a control group. Based on their findings, they suggest that these differences may be caused by soft-tissue restriction in the hip and decreased frontal pelvic ROM (anterior tilted pelvis) resulting from limited lumbosacral mobility.[22] Other case studies[43-46] have reported muscle length deficits, soft-tissue, and joint restrictions around the hip and lumbopelvic region in subjects diagnosed with FAI and labral tears. The correlation between muscle length deficits and the onset of FAI still needs to be more thoroughly inves-

tigated, however, should be considered during the clinical examination.

The weakness in this subject's hip flexors, abductors, and extensors may have had an influence on the patient's hip control during gait and functional activities. Casartelli et al [24,25] reported hip flexor weakness in patients with symptomatic FAI. Lewis et al[18] also found that patient with FAI demonstrated decreased force of the gluteal muscles during hip extension and the iliopsoas during hip flexion which increased the forces across the anterior hip. Hunt et al[21] observed kinematic and kinetic differences in patients with symptomatic FAI. Patients exhibited a significantly slower cadence, kinematically peak hip extension, adduction, and internal rotation during stance. Patients with FAI also exhibited less peak hip flexion and external rotation moments when compared to a control group.[21] These findings were consistent with the subject's right hip which have also been observed in other investigations.[22,26,47]

Functional Testing

Poor performance during lower extremity functional movements may have been related to muscle weakness and heavily influenced by a combination of pain and fear. The onset of the subject's right hip pain may have induced a fear avoidance reaction, which could explain some of the observed findings. This would not be unreasonable given the last episode of left hip pain resulted in a surgical procedure. Mannion et al[48] found that the top two pre-operative reasons for patients electing to have surgery for FAI included: "alleviation of pain" and "fear of worsening." Patients also tend to limit their motion during activity in the presence of pain. Limitations in hip flexion motion have been observed during squatting activities and gait in individuals with symptomatic FAI.[20] Patients with FAI also tend to restrict their motion in directions of hip joint impingement.[26]

Despite these observed findings, it must be acknowledged that several years had passed since the subject had been following post-operative guidelines and was motivated to return to his sport. At the time of the re-examination, the subject was physically active but had not been adherent with his original post-operative program. This subject may have benefitted from a more structured preventative program since the date of discharge. The examination findings in the right hip support the fact that the subject may have been predisposed to bilateral hip impingement and that his current hip pain was affecting his function.

The main limitation of this case report is that the clinical examination from the prior publication was reproduced in order to have a direct comparison between follow-up sessions. The original case report only used the NPRS to measure pain and did not include patient related outcome measures. Clinicians are encouraged to use patient related outcomes (PRO's) throughout the rehabilitation process in order to obtain a more objective, repeatable measurement of their patient's progress. There are many PRO's available for clinicians to use. Some of the more common questionnaires for non-arthritic pathology in young to middle age adults include: Copenhagen Hip and Groin Outcome Score (HAGOS), Hip Outcome Score (HOS), International Hip Outcome Tool-33 (IHOT-33) and IHOT-12 (Short version).[49] During the prior study, there was no hand held dynamometer or isokinetic device used to assess muscle strength or torque production, which would have provided a more objective measurement of the subject's muscle performance.[50] Therefore, during the current re-examination, muscle strength was tested without a dynamometer. Hip ROM in the prior study was measured with a standard goniometer which again was used in the re-examination to maintain intra-rater reliability.[34] For clinicians, the use of a digital inclinometer versus standard goniometry is preferred due to the enhanced accuracy of the device.[34,51] These factors must be considered when interpreting these finding for clinical practice. Clinicians are encouraged to use valid and reliable patient related outcome measures and digital devices for muscle testing and ROM in order to obtain the best objective measures.

Clinical Relevance

The re-examination findings and postulated risk factors are meant to highlight an understudied area and provide the clinician with potential risk factors based on the current evidence. One can surmise from the reported findings that the younger male subject may have been at risk for bilateral abnormal hip morphology since 2011. Also, his anterior tilted pelvis, muscle length deficits, and hip muscle weak-

ness may have contributed to his additional complaints of right hip pain or may be risk factors for future pathology in both hips. It appears that these impairments may have affected his overall gait and performance on functional tests. The main concern is the subject's recent onset of right hip symptoms and suggestion of intra-articular pathology. While the subject originally returned to high-level activities, risk factors may have existed to suggest the need for on-going, longitudinal monitoring after hip arthroscopy. Several authors have found a correlation between hip FAI and osteitis pubis,[27,28,30] athletic pubalgia,[29,52] and lumbosacral issues[30] which may be due from the excessive stress created through the lumbopelvic region during compensatory movements. The research in this area is still emerging. Currently, there is little epidemiological data on risk factors for further damage after hip arthroscopy or chances of getting a second FAI. There may not be enough longitudinal data to reveal any trends. Only surgical complications have been reported in the literature.[53]

CONCLUSION

This case report is the first to document a 3.6 year follow-up for a young adult male subject after unilateral hip arthroscopy and acetabular labral repair. The re-examination findings and postulated risk factors are unique to the subject, which must be considered when interpreting these findings for clinical practice. The detailed reporting of the long-term effects of a post-operative program after hip arthroscopy has not been reported in the literature. This case report presented the longitudinal finding and compared them to the current literature. Several potential risk factors were discussed that could have an influence on the occurrence of future pathology or concomitant injury but all of these need to be studied using other research methods. This understudied topic leaves a gap in the current knowledge on the effectiveness of post-rehabilitation after hip arthroscopy. Clinicians and researchers are encouraged to conduct longitudinal follow-ups on their patients in order to assess the long term effects of the interventions.

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