



Information for Nurses on Return to Sport After Periacetabular

Osteotomy Surgery

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Abstract

The purpose of this study was to answer the following question: Does the amount of physical therapy after PAO surgery for hip dysplasia, impact the ability of a patient to return to sporting activities? PAO surgery refers to Periacetabular Osteotomy surgery; a corrective surgical technique for hip dysplasia that aims to preserve the hip, rather than replace it. This question was addressed using a mixed methods survey designed to collect qualitative and quantitative data regarding patient experiences after PAO surgery. The survey was posted on two different Facebook pages: Post-PAO Return to Sport and Young Hip Impingement/Dysplasia (FAI, THR, PAO) Support. A linear regression was performed to analyze the results of the data. The data did not show a relationship between the amount of physical therapy and the ability to return to sport following a PAO operation. However, the data did show that patients who used a mobility device for longer than 8 weeks were on average 24.5% more likely to return to sports within 9 months compared to patients who used a mobility device for less than 8 weeks ($p=0.245$). No other statistically significant results were found. During the literature review for this study, it was established that there is insufficient research conducted on rehabilitation after surgery for hip dysplasia.

Keywords: Periacetabular Osteotomy (PAO), Hip Dysplasia, sports, physical therapy, mobility device

Background

The Periacetabular Osteotomy (PAO) surgery, first described by Ganz et al. (1988), is a surgical procedure for hip dysplasia in skeletally mature patients looking to preserve hip function. Although total hip replacement is a treatment option for this patient population, functional outcomes are imperative to maintain activity levels and exercise for younger patients. The PAO surgery corrects abnormal weight distribution across the joint articulation and increases femoral head coverage to stabilize the hip joint and reduce pain. Although this procedure is gaining traction in medicine to preserve hip function and avoid replacement, there is limited research and data regarding recovery and rehabilitation after surgery. This research strives to identify the impact of PAO surgery and post-surgical physical therapy on the ability of the patient to return to preoperative sports activity level.

Hip dysplasia is a condition in which the bones of the pelvis do not develop completely resulting in a shallow hip socket. This underdeveloped hip socket may not cover the femoral head properly or may be misaligned which can cause the degeneration of cartilage surrounding the acetabular joint or the tearing of the labrum if left untreated. Degeneration of surrounding cartilage structures can lead to osteoarthritis, a condition in which protective cartilage structures wear down to the point where bone rubs against bone during movement. Osteoarthritis restricts mobility and can cause pain. Thus, if the hip dysplasia is caught early enough and PAO surgery is performed, the hip can be preserved with limited injury and the patient can avoid total hip replacement.

During a Periacetabular Osteotomy Surgery, the surgeon makes several cuts into the bone surrounding the joint to rotate the socket to the proper alignment. Once in place, metal screws are inserted to hold the bone still during the healing process. A PAO surgery might be recommended for someone who is still experiencing pain regardless of non-surgical treatments, rest, physical therapy, or medication. To determine the selection criteria for PAO surgery, the lateral center-edge angle (LCEA) is found on an AP pelvic radiograph. A best-fit circle is drawn for the medial and inferior margins of the femoral head. From the center of that circle, one line is drawn running vertically through the longitudinal axis of the pelvis, and another is drawn laterally to the acetabular rim. In a fully developed hip, the normal range for the LCEA is 25° to 39°. Although the selection criteria for a successful PAO surgery have not been thoroughly researched, any angle below 25° accompanied by other symptoms of hip dysplasia, such as pain or limited mobility, is considered operable (Yasunaga et al., 2012).

Periacetabular Osteotomy Surgery is a relatively new procedure, first introduced by Dr. Reinhold Ganz in 1988. It is increasing in popularity now that patients and surgeons aim to preserve the hip rather than replace it. Several studies have been conducted revealing medium to long-term hip survivorship and functional outcomes, but there is limited research being conducted on activities of daily living, quality of life, and recreational use of post-PAO hips. These other aspects of recovery should be explored and documented for long-term follow-up measures. Due to the lack of research on additional outcome measures of hip functionality, this research aims to answer the following question: does the amount of physical therapy a patient receives affect the patient's ability to return to sports activities following Periacetabular Osteotomy surgery for hip dysplasia?

Literature Review

In order to understand the foundation of research already established on this topic, a literature review was conducted using the CINAHL, PubMed, and Google Scholar databases.

Articles published between January 2002 and December 2020 were included for consideration. To the Author's Knowledge, no studies included in this review provide a time frame for physical therapy, mobility device use, or return to sport following PAO surgery. Articles published on similar procedures, such as Femoroacetabular Impingement (FAI) and Total Hip Arthroplasty surgeries (THA), were also included due to the limited amount of research on returning to sport following a PAO.

The following criteria were used for inclusion in this research:

- The article was published between 2002 and 2021.
- The article's main topics included PAO, FAI, or Total Hip Arthroplasty.
- The research focused on functional ability, activity level, physical therapy, return to sports, or comparative measures of pre and post-surgery for PAO, FAI, or THA patients.

The literature review revealed the following themes: Corrective hip surgery significantly improved pain and functionality, the majority of hip surgery patients can return to sport at or near the same pre-surgery level, and the majority of patients are satisfied with their improved quality of life following Periacetabular Osteotomy, Femoroacetabular Impingement, and Total Hip Arthroplasty surgeries.

Improved Pain and Functionality

In a cross-sectional review conducted on 52 patients, 68 hips (some patients had PAO surgery on both hips), it was reported that PAO surgery significantly improved quality of life, ability to do sports, and ability to participate in social activities ($p < 0.001$). The same research also found that pain, stability, and limps were all improved ($p < 0.001$) for nine to twelve years following surgery (Klit et al., 2013). The article emphasizes that PAO surgery is geared toward a younger patient population and that factors such as pain, social ability, and sports activities are essential to measure due to the high demands placed on the hips of patients in this population.

Similarly, a cohort study conducted at the University of British Columbia utilized the Western-Ontario McMaster (WOMAC) and the Short Form 36 (SF-36) scales to measure outcomes following PAO surgery. The WOMAC measures pain, stiffness, and functionality and is typically used to assess functionality with osteoarthritis in the hip. The SF-36 is a general assessment tool used to measure the global functional outcome after a variety of surgical procedures (Bergayk et al., 2002). It is a series of eight scaled scores that add up to 100. A lower score on the SF-36 indicates more physical debility. Using the WOMAC, the research found that there were improvements in all categories; pain, stiffness, and functionality. The SF-36 was used to compare pre and post-operative functionality as well as compare these values to the general population. The mean values pre and post-operative respectively were 33 and 49. The SF-36 mean physical score for the general population, meaning people aged 25 to 34 years with no chronic health conditions was 55.26 and 53.44 as reported by the Medical Outcome Surveys. Thus the cohort study concluded that "following periacetabular osteotomy patients have a highly significant improvement in physical function and pain as assessed by the SF-36 global and WOMAC disease-specific health-related quality-of-life measures" based on the SF-36 post-surgical score being close to that of the general population (Bergayk et al., 2002, p.342).

Returning to Sport Outcomes

Before diving into research surrounding sports outcomes, it is important to note that measuring the ability of patients to return to their sport is challenging. Patients have different pre-surgical abilities and intensity of sporting activities, as well as other confounding factors that can affect their ability or desire to return to their sport. A study that focused on qualitative results of surgical treatment for hip impingement found that variables such as aging, self-motivation,

pain, adaptation to physical changes, and the presence of a support system can largely impact the decision to return (Tjong et al., 2016). This literature review acknowledges these limitations regarding confounding variables related to returning to sport after a hip surgery.

A systematic review conducted on 189 athletes following surgery for hip impingement (FAI), used a strict definition of return to sport to ensure the most accurate data was collected. The study reported that 57% of the athletes were able to return to sport at their pre-injury level which is a lower percentage when compared to other studies that simply measured returning at all. Of the 57% that returned at the same level, one-third (16.9% of the whole sample), reported optimal physical ability which corresponded to having better hip/groin functionality (Ishoi et al., 2018). Although this research was conducted on a different hip procedure, it was included in this literature review due to the similarities between hip dysplasia and hip impingement, as well as the focus on returning to sport after the surgery. This research alludes to the theme that corrective hip surgery does positively impact a patient's ability to return to sport.

Likewise, a retrospective case series was conducted using the Harris Hip Score, Hip Dysfunction and Osteoarthritis Outcome Score, Western Ontario and McMaster Universities Osteoarthritis Index, and the University of California–Los Angeles Activity Score to measure activity tolerance after PAO surgery (Bogunovic et al., 2014). The study concluded that “the majority (71%) of active patients with hip dysplasia return to pre-surgical or higher activity levels after open hip preservation surgery with the periacetabular osteotomy” (Bogunovic et al., 2014, p.1791). Scores in all of the scales, except the University of California-Los Angeles scale, saw improvement. This research also supports the theme that PAO surgery leads to positive results in active patients looking to return to their sport of choice successfully. Although no variables leading to a successful return were measured, the research discussed indicates that returning to sport is possible and supports the notion that further research should be conducted to investigate proper rehabilitation protocol to lead to a successful return.

Patient Satisfaction

Patient satisfaction is very important to measure in all cases, but especially in the younger patient population because of the high physical demand placed on these hips. A study in Quebec was conducted comparing sport-related outcomes and patient satisfaction after resurfacing hip arthroplasty (RHA) and total hip arthroplasty (THA) (Lavigne et al., 2008). The research utilized a visual analog scale to measure patient satisfaction on a scale of 1 to 10, with 10 being the highest level of satisfaction. The median satisfaction for RHA was 7.78, while THA patients reported a median of 7.43. Both indicate a positive experience with the corrective hip procedures as the medians were over 50% in satisfaction. As stated above, although this study includes data about a different hip procedure, it was included due to the sport-specific and patient satisfaction focus, as well as the limited research conducted on these topics regarding PAO surgery.

The cross-sectional review on 52 PAO patients, also measured patient satisfaction alongside quality of life improvement. The median satisfaction rating was 5, on a scale of 1-5, with 1 being the lowest level of satisfaction and 5 being the highest level of satisfaction. Forty-four out of 49 patients reported that they would undergo the surgery again (Klit et al., 2013).

This literature review strives to uncover evidence on the improvement of hip functionality, ability to return to sport, and patient satisfaction following various hip-preserving/correcting procedures. When conducting this review, it became abundantly clear that there is limited research in the field of PAO surgery at all. Thus, to the Author's knowledge, there is no research specifically related to the effect of physical therapy on return to sport

following a Periacetabular Osteotomy. Consequently, this research attempts to advance this field of research.

Purpose

To investigate the connection between the amount of physical therapy a patient receives and the effect it has on the patient's ability to return to sports activities following Periacetabular Osteotomy surgery for hip dysplasia.

Methods

This retrospective case series aimed to determine if there is a correlation between physical therapy and return to sport in patients who have undergone PAO surgery for hip dysplasia.

The study was granted IRB exemption by the Institutional Review Board at UNC Chapel Hill. The study participants were identified through 2 Facebook support pages for PAO patients: Post-PAO Return to Sport and Young Hip Impingement/Dysplasia (FAI, THR, PAO) Support. Participation was voluntary with participants answering survey questions posted on each page. Completion of the survey indicated consent. The survey was posted twice, with two weeks in between the posts. The survey was open for approximately one month and closed on January 1st, 2021. There were 68 total responses. The following age ranges were reported by participants: under 25 years (n=29), 25-34 years (n=16), 35-44 years (n=14), 45-54 years (n=7) and 54-64 years (n=2). There were 67 females and 1 male who completed the survey.

Materials

A mixed methods survey design was used to collect qualitative and quantitative data. No existing surveys fully met the study purpose; therefore, one was developed in combination with the Hip Outcome Score (HOS)- Sports subscale. The questions included open-ended statements and multiple choice selections. The survey consisted of 17 questions: 3 demographic, 3 confounding variable questions to evaluate medical conditions at the time of surgery, 9 surgical experience questions to gauge recovery time, physical therapy, mobility device use, and adherence to medical advice, and 2 Likert scale questions using the Hip Outcome Score Sport Subscale to measure pre and post-surgical activity tolerance (Appendix). The survey was distributed using Qualtrics Experience Management Software™.

Statistical Analysis

A linear regression was performed specifically looking at the following dependent variables from the survey: the ability to return to sport within 9 months and the ability to return to sport with at least 75% prior functional ability. These two-dependent variables were compared to the following independent variables: Hip Outcome Pre-surgical score, the use of mobility devices for longer than ten weeks (ex: crutches, walker, cane), and physical therapy for longer than ten weeks. A p-value less than 0.1 was considered statistically significant.

Results

Participants (n=68) included 77 hips, with 9 participants reporting PAO surgeries in both hips. Sixty-seven females and one male completed the survey, with an average age of 25 years (range, 13-47 years) at the time of surgery. According to the Hip Outcome Score Sport-Subscale, the average hip outcome pre-operatively was 54.5% (range, 18.2%-100%). Post-operatively, the average Hip Outcome score was 79.4% (range, 0%-100%) with 14 participants (20.6%) submitting a lower score postoperatively compared to their preoperative score. Twenty-three participants (33.8%) reported using mobility devices for longer than ten weeks postoperatively while 18 participants (26.4%) reported using them for 8 to 10 weeks. The remaining 27 participants (39.8%) used mobility devices for less than 8 weeks. Fifty-one participants (75%)

were in physical therapy for longer than 10 weeks. The remaining 17 participants (25%) reported doing physical therapy for anywhere between 4 and 8 weeks.

In the six linear regression calculations that were analyzed, only one proved to be statistically significant. It was found that patients who used a mobility device for longer than eight weeks were on average 24.5% more likely to return to sport within nine months compared to patients who used a mobility device for less than eight weeks ($p=0.245$). However, the length of mobility device use did not affect the ability to return to sport with 75% of presurgical ability ($p=1.113$). Having a higher presurgical Hip Outcome Score showed no effect on returning to sport within nine months ($p=1.008$) or returning with 75% of presurgical ability ($p=1.019$). Likewise, doing physical therapy for more than ten weeks showed no effect on returning to sport within nine months ($p=0.933$) or returning with at least 75% of presurgical ability ($p=0.705$).

Table 1:

Statistical Analysis Results

	<i>Dependent variable:</i>	
	Returned within 9 months (1)	Returned at least 75% of prior functional ability (2)
Pre-score	1.008 (0.980, 1.037)	1.019 (0.991, 1.050)
Mobility Assistance: Greater than or equal to 8 weeks	0.245** (0.079, 0.694)	1.133 (0.395, 3.215)
Physical Therapy: Greater than 10 weeks	0.933 (0.264, 3.257)	0.705 (0.188, 2.376)
Intercept	1.877 (0.318, 12.176)	0.806 (0.130, 4.955)
Observations	66	65
Log Likelihood	-41.901	-41.896
Akaike Inf. Crit.	91.803	91.792

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$
 Mobility Assistance has an overlap in ranges (0-2, 2-4, 4-6, 8-10, Greater than 10), so it's possible that a person who received exactly 8 weeks of Mobility Assistance could be included in our 'Greater than or equal to 8 weeks' (= 8-10, Greater than or equal to 10) category or not.

Discussion

Patients with hip dysplasia may present with symptoms such as pain, limping, and unequal hip flexibility. Hip dysplasia can lead to painful complications such as a labral tear or osteoarthritis. Seeing as hip dysplasia is now screened for at birth, the frequency of PAO surgeries may decrease in the future but currently, there is a push towards hip preservation, rather than hip replacement in young patients with hip dysplasia to manage symptoms. According to the Arthritis Foundation (Johnson, 2021), most people undergo hip replacement between the ages of 50 and 80 years old. This is consistent with the American Joint Replacement Registry's average age of 67.4 years (Johnson, 2021). Seeing as hip dysplasia patients can start showing symptoms at an early age, periacetabular osteotomy surgery may be the treatment of choice to avoid the introduction of foreign material (artificial joints) into the body. Also, altering the shape of the natural joint avoids the risk of the artificial hip breaking or wearing down over time, especially in physically active patients who put more demand on their hips. Thus, PAO surgery seems to be a proactive treatment choice in the disease process of hip dysplasia in patients under 50 years of age with better long-term implications and easy conversion to a total arthroplasty is necessary.

Since periacetabular osteotomies provide significant improvement in pain, functional ability, and quality of life, the primary aim of this study was to investigate the ideal rehabilitation practices to foster optimal recovery after surgery. Initially, the research focused on the impact of physical therapy on how fast a patient was able to return to sport. The data proved that focusing on other factors, such as the length of use of mobility devices and Hip Outcome Pre-Score, could influence return to sport as well.

The influence of the length of mobility device use and physical therapy on return to sport following a periacetabular osteotomy surgery has not been previously reported. It was hypothesized that having at least ten weeks of physical therapy would increase a patient's chance of returning to sports by at least 75% and decrease the likelihood to return to sports within nine months. The data indicated that more than ten weeks of physical therapy has no statistically significant impact on the patient's ability to return to sport or at what percentage of their presurgical ability they can return. It was then hypothesized that using mobility devices for more than ten weeks would decrease a patient's ability to return to sport within nine months and increase their ability to return to sport with at least 75% prior capabilities. This research indicated that longer use of mobility devices (more than ten weeks) had a statistically significant positive effect on shortening the length between surgery and returning to sport but, the research did not indicate any relationship to being able to return at 75% ability. This research acknowledges that many factors can affect the length of rehabilitation following surgery. The survey used to gather this data accounted for these factors by asking about the age at surgery, history of chronic conditions, other hip procedures the patient has undergone, and how strictly the patient followed weight-bearing and home physical therapy instructions.

When looking for a valid and reliable scale to gauge sport-specific outcomes, the Hip Outcome Score proved to be the best quantitative scoring system for the musculoskeletal pathology of hip dysplasia specifically in reference to sport-related activities. The Hip Outcome Score was deemed valid by Martin and Philippon (2007) when used as "diagnostic criteria in a study of non-consecutive patients" (p.822). Patients score themselves, using a Likert scale, based on their ability to perform nine-different movements that are specific to sporting activities. It was hypothesized that having a higher pre-surgery score would indicate that a patient would return to sport within nine months and be able to return with at least 75% ability. Our research indicated that there is no correlation between a higher Hip Outcome Score pre-score and returning to sports in nine months ($p= 1.877$) or returning at 75% ability or higher ($p=0.806$). Thus, including this scale in our survey served only to gauge activity tolerance improvement or decline after surgery.

The following limitations in our research should be acknowledged. First, the study sample was 68 participants, thus the results are not generalizable. There were other confounding variables, such as age at the time of the procedure, that did produce statistically significant results in our dependent variables. However, 15 study participants did not fill out this information, so the data were excluded. Further research with larger sample sizes should be conducted. Second, recall bias is introduced by the Hip Outcome Score of pre-operative abilities, subjective determinations of how strictly the participants followed weight-bearing and physical therapy instructions, as well as subjective interpretations of the percent of pre-surgical ability at which participants were able to return to their sport. To the Author's knowledge, there is no valid or reliable scale to measure these parameters in patients who have undergone PAO surgery.

Information for Orthopedic Nurses

As the role of the nurse includes being an advocate in the care of patients and supporting them through their healthcare journey, nurses must be informed with the most current information available regarding care. This research provides new substantial evidence that can increase the quality of care provided by nurses to recovering PAO patients. For example, using the results discovered through this statistical analysis, nurses can enrich the education given to PAO patients. This education could include encouraging patients to follow their physical therapy exercises strictly. As well as, communicating the importance of complying with weight-bearing

restrictions and the use of mobility aids to ensure maximum recovery and increase the probability of a successful return to sport or previous activity level.

Conclusion

Periacetabular Osteotomy surgery is a hip-preservation treatment approach for young adults suffering from hip dysplasia. This study utilized a unique survey of questions, in combination with the Hip Outcome Score-Sport subscale, to evaluate the relationship between physical therapy and the ability of a patient to return to sport. During analysis of the data, no correlation was identified between the amount of physical therapy and its impact on returning to sport. However, the statistics showed that using a mobility device for longer than ten weeks increased the probability of returning to sport within nine months by 24.5%. No other statistically significant results were found. During the literature review conducted for this study, it was noted that there is a striking lack of research conducted on the outcomes following PAO surgery. Further research is warranted to determine ideal rehabilitation measures for optimal return to sports results for Periacetabular Osteotomy patients.

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Appendix A: Hip Outcome Score (Sports Subscale)

Before surgery

	No difficulty at all	Some difficulty	Moderate difficulty	Extreme difficulty	Unable	N/A
Running one mile						
Jumping						
Swinging objects like a golf club						
Starting and stopping quickly						
Cutting/lateral movements						
Low-impact activities like fast walking						
Ability to perform activity with your normal technique						
Ability to participate in your desired sport as						

long as you would like						
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(Cont'd: Appendix A)
After surgery

	No difficulty at all	Some difficulty	Moderate difficulty	Extreme difficulty	Unable	N/A
Running one mile						
Jumping						
Swinging objects like a golf club						
Starting and stopping quickly						
Cutting/lateral movements						
Low-impact activities like fast walking						
Ability to perform activity with your normal technique						
Ability to participate in your desired sport as long as you would like						

Appendix B: Sociodemographic and Treatment Survey

Age at PAO surgery: (fill in the blank)

- **Sex:**
 - Male
 - Female
 - Choose not to report

- **Current Age:**
 - Under 25
 - 25-34
 - 35-44
 - 45-54
 - 54-64
 - Above 65
 - Choose not to report
- At the time of PAO surgery, did you have any medical conditions/diagnoses related to the following systems : (select all that apply)
 - Diabetes
 - Cardiac issues
 - Vascular issues
 - Pulmonary issues
 - Musculoskeletal problems
 - Neurological deficits
- Have you had any other hip surgeries other than PAO?
 - Yes
 - No
 - If yes was answered to the previous question, what was the name of the surgery?
 - What was the date of the surgery? (Month and year)
- How long did you use any type of mobility device (ex: crutches, walker, etc) after PAO surgery?
 - 0-2 weeks
 - 2-4 weeks
 - 4-6 weeks
 - 6-8 weeks
 - 8-10 weeks
 - Longer than 10 weeks
- How long were you in physical therapy?
 - 0-2 weeks
 - 2-4 weeks
 - 4-6 weeks
 - 6-8 weeks
 - 8-10 weeks
 - Longer than 10 weeks

- How many days a week did you attend physical therapy?
 - 0-2 days
 - 3-4 days
 - 4-6 days
 - 7 days

- How long were your physical therapy sessions?
 - 0-15 minutes
 - 15-30 minutes
 - 30-45 minutes
 - 45-60 minutes
 - Longer than 60 minutes

- How strictly did you adhere to physical therapy instructions regarding exercises at home?
 - 100%
 - 75%
 - 50%
 - 25%
 - I did not adhere to physical therapy instructions.

- How strictly did you adhere to weight-bearing instructions following PAO surgery?
 - 100%
 - 75%
 - 50%
 - 25%
 - I did not adhere to weight-bearing instructions.

- Did you have any post-surgical complications?
 - Yes
 - No

- How long after PAO surgery were you able to return to sport?
 - 0-3 months
 - 3-6 months
 - 6-9 months
 - 9-12 months
 - Greater than 12
 - I did not return to sport

- Compared to your preoperative activity level, at what percentage were you able to return to sport after PAO surgery?
 - 0-25%
 - 25-50%
 - 50-75%
 - 75-100%

Appendix C: Literature Matrix

Study author	Year	Number of participants	Sample characteristics	Study design	Measures
A B van Bergayk D. S. Garbuz	2002	24 women 1 Man Mean age of 32	Patients with hip dysplasia who underwent Bernese PAO	Cohort study	-WOMAC SF-36 -Hip and Knee Arthroplasty Satisfaction Scale (HKASS) -a sports-activity questionnaire, as described by Tegner & Lysholm
J. Klit, C. Hartig-Andreasen, K. Soballe, A. Troelsen	2013	52 patients (68 hips) Mean age: 41 y	Younger adults who underwent PAO surgery and were willing to fill out a survey up to 10 years post-op	Cross-sectional cohort study	-Survey to measure satisfaction, quality of life, social activity ability, sex-life, pain, willingness to repeat surgery, limp, and stability of the hip after surgery
L. Bogunovic D. Hunt H. Prather P. Schoenecker J. Clohisy	2014	36 patients (39 hips) 15 males 21 females Average age: 25 y	Active patients who received PAO with pre-op University of California-Los Angeles score of >7	Retrospective Case series	-Harris Hip Score -Hip Dysfunction and Osteoarthritis Outcome Score -Quality of Life -Western Ontario and McMaster Universities Osteoarthritis Index -The University of California-Los Angeles- score
V. K. Tjong C. Cogan	2016	23 patients	Patients aged 18-60 who	Case series	-Semi-structured interviews

B. Riederman M. Terry			had arthroscopic hip surgery for FAI and pre-surgery involvement in sports and a minimum of 2-year follow-up with no surgery revision		-Current modified Harris Hip Score (mHHS), -International Hip Outcome Tool (iHOT-12), -Hip Outcome Score–sports-specific subscale (HOS-SSS), -Coping mechanism evaluation (Brief COPE)
M. Lavigne V. Masse J. Girard AG. Roy PA Vendittoli	2008	205 hips	Patients who underwent resurfacing hip arthroplasty (RH) or total hip arthroplasty (THA)	Retrospective cohort study	- University of California, Los Angeles (UCLA) score -The Western Ontario McMaster Osteoarthritis Index (WOMAC) score -Visual analog scale to measure patient satisfaction, return to sports activities, and factors that limit activity.
I. Lasse K. Thorborg O. Kraemer P. Holmich	2018	189 Athletes	Athletes who underwent hip arthroscopy for femoroacetabular impingement syndrome	Cross-sectional study	-Copenhagen Hip and Groin Outcome Score. -Return to sports questionnaire
B. Domb C. Stake N. Finch T. Cramer	2014	27 orthopedic surgeons	Surgeons from high-volume hip arthroscopy	Level V-Expert Opini	-Survey regarding return to sport after hip arthroscopy. - Also, the surgeons

			centers	ons	were asked to rank common sports as high, medium, or low risk concerning the hip.
A. Weber B. Kuhns G. Cvetanovich J. Gryzbowksi M. Salata S. Nho	2016	66 athletes (26 male, 40 female)	Consecutive athletes undergoing hip arthroscopy for femoroacetabular impingement.	Cohort study	-Sport-specific questionnaire -Modified Harris Hip Score -Hip Outcome Score with Activities of Daily Living -Sport-specific subscales
N. Casartelli M. Leunig N. Maffiuletti M. Bizzini	2015	18 studies	Studies that evaluated return to sport in athletes who underwent surgery for FAI	Case series	EMBASE PubMed Web of Science Cochrane Library