Original article

Outcomes in arthroscopic surgery and proposal rehabilitative treatment in femoral acetabular impingement syndrome

Paolo Di Benedetto[1,2], Daniele Vidi[2], Michele Mario Buttironi[1], Francesco Mancuso[1], Marco Ricciarelli[1], Araldo Causero[1,2]

[1]Clinics of Orthopedics ASU FC, Udine, Italy; [2]Medical Department, University of Udine, Italy; [3]IMFR Gervasutta, Udine, Italy

Abstract: *Background and aim of the work.* Femoral Acetabular impingement syndrome (FAIS) is a pathologic condition that can lead to hip pain, functional limitation and stiffness. In the last few decades orthopedics and physiotherapists have improved both surgery and rehabilitative treatment leading to a better and better treatment. The target of this paper il to verify the efficiency of an early and multimodal physiotherapy treatment after and arthroscopic surgery of the FAIS. *Materials and Methods.* We performed arthroscopic treatment and rehabilitation on 19 patients with mean age of 37±8,3 years, 12 males and 7 females. Each patient has been evaluated preoperatively (T0), postoperatively after 6 week (T1) and after 3 months of follow up (T2), assessment was carried out by: administration of the VAS and WOMAC score for pain and function and joint examination of active hip movement through an inertial sensor system. *Results.* VAS score shows a decrease of pain after 6 week (mean decrease was 36%) and after 3 months (mean decrease was 33%). WOMAC score shows an increase of the functional performance of the hip after 3 weeks and after 3 months (in both phases the mean score increase of the 44%). At last, the analysis of the active movement and of the hip joint showed a generalized increase in all movements both 6 weeks and 3 months after surgery, in particular for flexion (with the knee flexed) and internal rotation movements. of the hip. *Conclusion.* The results of this study are in line with the current scientific literature and the protocol used represents a valid tool to complete the surgical treatment. The proposal of an early, intensive treatment combined with hydro-kinesitherapy seems to be safe and effective, however further studies are needed (increasing the sample size) to investigate the results.

Key word: FAI, arthroscopic surgery, rehabilitative treatment, Hip, Hip Arthroscopy

Introduction

Femoral Acetabular impingement syndrome (FAIS) is due to a series of congenital or acquired pathologies of the hip which has as main pathogenetic element a premature contact between the proximal femur and the acetabulum during the hip movements.

The first case was described in the 30's by Dr. Smith-Petersen and, later, in the 60's, Murray (1) described how an alteration of the head-neck junction of the femur that could lead to coxarthrosis. This concept was later resumed and consolidated in the 1990s by Myers et al. (2) and in 2003 by Ganz et al. (3) who published an article still considered today as the introduction of femoral-acetabular impingement pathology.

This condition can lead to hip pain, joint and functional limitations up to cause lesions of the cartilage and / or the acetabular labrum, factors, that can predispose the onset of hip arthrosis in later life (3-5).

Other factors can favor the onset of conflict as: some pediatric hip diseases such as congenital dysplasia and Legg-Calvè-Perthes disease but also specific sports activities such as: hockey, football, dance, tennis, weight lifting, horse riding (6).

There are three main impingement mechanisms, classified on the morphological anomalies: "CAM", "PINCER" and "MIXED" (7, 8).

The age range most affected by FAIS is between 25 and 50 years, with the highest prevalence in males (9). Cam-type anomalies affect more young males who practice sports; the pincer type most often involve middle-aged women (7, 8). The most common form is the mixed one (8, 9).

On physical examination it is possible to detect a joint limitation, even quite marked, especially in internal rotation and flexion, sometimes in abduction (8, 10, 11). In the literature, various clinical tests are proposed that can help to make the diagnosis:

FADIR test: the most sensitive, as well as the only one validated for the screening of impingement (9, 12).

FABER test: non-specific to evaluate a functional deficit of the hip, positive if it produces groin pain (10).

Posterior rim impingement test: positive if the symptom is evoked or the patient demonstrates apprehension (7). Other orthopedic tests or functional tests may also be administered.

Currently, literature affirm that surgical treatment leads to better outcomes compared to conservative treatment (13, 14), however it also depends on the post-operative rehabilitation. Regarding the timing of recovery, it is reported that most of the symptoms subside within 6 months after surgery, but the healing process continues for up to a year (7, 15). The return to sport is variable from 3 to 9 months (9, 16).

Now no clear evidence is available on the post-surgical rehabilitation treatment of femoral-acetabular impingement. Four phases of intervention are classically identified (plus a pre-operative one). There is a heterogeneity in the literature that does not allow a definition of a standard protocol or reliable guidelines even if there are several studies that are investigating the effectiveness of post-surgical physiotherapy and conservative treatment (16-23).

By the way, the proposed rehabilitation treatments have obtained good clinical and functional results, physiotherapy remains an integrated part of the patient's care path (24) as reported in "The Warwick Agreement on femoroacetabular impingement syndrome: an international consensus statement" of 2016, and is a fundamental step for safe sporting recovery (10) (Figure 1).

Objectives

All the patients involved in the study were operated (by the same surgeon PDB) at the Orthopaedic Clinic of the Santa Maria della Misericordia Hospital in Udine and were rehabilitated (by the same Physiotherapist) at the Degree Course in Physiotherapy of the University of Udine. (Italy).

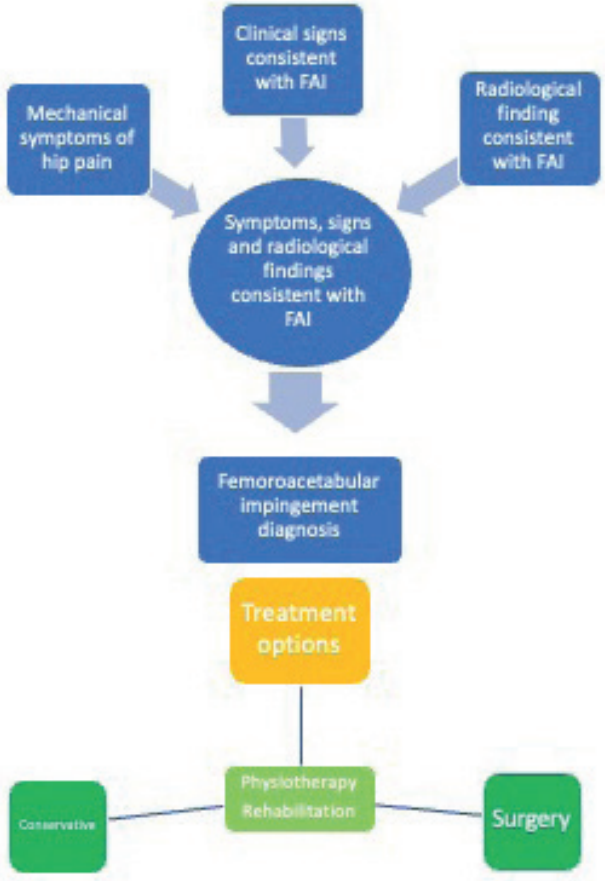

Figure 1. Pathway for femoral acetabular impingement syndrome treatment Griffin D.R., Dickenson E.J., O'Donnell J., Et Al. (2016), "The Warwick Agreement on femoroacetabular impingement syndrome (FAI syndrome): an international consensus statement", Br J Sports Med., 50(19), 1169-1176. (25)

The specific objectives of this study are:

Evaluate the results of arthroscopic surgical treatment at 6 weeks and 3 months in patients diagnosed with femoroacetabular impingement, evaluation outcome: pain, function and articulation of the operated hip.

Verify the effectiveness of a multimodal rehabilitation protocol (combined between exercise, hydrokinesitherapy and manual therapy).

Sample

The sample of this study consists of 19 patients, 12 male, 7 female. The mean age of the sample is 37±8.3 years, with age between 16 and 49 years. All participants provided written informed consent to participate in this study.

- 13 patients had MIXED FAI
- 4 patients had CAM type FAI;
- 2 patients had PINCER type FAI;

14 patients underwent arthroscopic acetabular rim trimming and osteochondroplasty of the femoral head-neck junction, in one subject, in addition to these two procedures, the removal of os acetabuli and regularization of the anterior inferior iliac spine was performed.

For subjects with CAM-type impingement, only the osteochondroplasty procedure of the femoral head-neck junction was performed; none of the patients underwent a suture of the acetabular labrum. An extra-articular approach without traction as described in a previous paper by Di Benedetto et al. (25) is preferred.

All the subjects of the sample followed the same rehabilitation program.

The inclusion criteria for the study were:

- Diagnosis of femoroacetabular impingement
- Scheduled hip arthroscopy surgery.

The exclusion criteria were:

- Previous interventions on the same hip
- The presence of neurological or rheumatological pathologies.

Materials and Methods

The tools for evaluating femoroacetabular impingement from the rehabilitation point of view are not many or at least they are not clear in literature (40). In this study it was decided to carry out three evaluations distributed over time:

T0: in the preoperative phase (the week before surgery);

T1: at the end of the rehabilitation treatment (at 6 weeks p.o.);

T2: follow-up (at 3 months p.o.).

For the motion assessments The BioVal® system has been used, which allows kinematic measurements to be carried out in the three planes of space by the use of inertial sensors. Active hip movements were recorded in: extension, flexion, ab-adduction and intra- and extra-rotation by asking the patient to perform the movement twice, trying to reach the maximum excursion.

The VAS (Visual Analogic Scale) was used for pain analysis and the WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) scale for functionality, both self-compiled (Figure 2).

This study was conducted under the principles of the Declaration of Helsinki.

Data analysis

The average of the "VAS" score, the "WOMAC" score and the articular analysis was calculated for each evaluation, then was calculated the difference between the three averages in the different stages of evaluation.

Figure 2. Representation of the articular movement recording

Continuous variables are presented through mean and standard deviation (SD); variables' distribution was assessed by the Shapiro-Wilk test. Comparisons before and after surgery were based on paired t-test or Wilcoxon signed-rank test as appropriate. An α-level equal to 0.05 was assumed as guide for significance. All analysis were perfomed using STATA software version 13 (StataCorp, College Station, TX).

Rehabilitation protocol

Phases of the rehabilitation process: The rehabilitation process was divided into 3 phases

Phase I or protection (0 to 2 weeks p.o.)

Phase II or middle (2 to 4 weeks p.o.)

Phase III or advanced (4 to 6 weeks p.o.)

The progression of treatment from one phase to another was managed on the basis of the clinical answers given by the patient or the achievement of objectives.

Protection phase

The recovery of the complete range of motion is the fundamental point of this phase which is done mainly in water.

Objectives: tissue protection, management and reduction of any oedema-hematoma, pain and inflammation management, prevention of secondary damage (stiffness, adhesions, muscle atrophy), recovery of the range of motion and correct movement patterns, increase and maintenance of muscle tone-trophism, improvement of overall postural control, gradual restitution of the load.

Rehabilitation strategies

Treatment in the pool (45 minutes) or in the gym, the load is increased on the operated limb until the crutches are abandoned, progressively passing from 2 to 1 crutch within 7-10 days and then free gait after 14 days.

Middle phase

Proprioception is the focus of the middle phase and comprehends strategies in the water and in the gym. Walking re-education remains fundamental.

Objectives: recovery of complete range of motion, increase in neuromuscular control and proprioception, tissue elasticity, increase in muscle strength of the lower limbs with particular attention to gluteal muscles, deep hip rotators, iliopsoas and tensor of the fascia lata, reaching the complete load and normalization of the gait.

Rehabilitation strategy:

Water sessions increase in intensity, repetitions and speed of execution with new exercises compared to the previous phase.

In this phase, it is important to achieve complete (or almost) range of motion, in particular rotations, which are the most critical element in the post-surgery.

Stretching of the quadriceps femoris, iliopsoas, tensor fascia lata, intrinsic muscles of the hip, gluteal muscles, adductor and hamstring muscles. Muscles are also treated with manual therapy. Segmentary and global muscle strengthening exercises are proposed in different ways: elastic, leg press, squats, lunges. At the same time, cardio-vascular training on a cycle ergometer progresses, an element already introduced in the first phase, but which now with progressive intensity and effort for the subject.

Advanced phase

The last phase of the treatment is focused on Strength and endurance. The sessions are exclusively carried out in the gym, to lead the patient to a possible return to sporting activity or in any case to obtain an optimal quality of life and maintain the objectives acquired in the previous stages.

Objectives: optimization of balance and proprioception, increase in endurance and resistance, increase in muscle control and strength, return to daily activities without deficit and gradual recovery of the sporting gesture, not earlier than 6 weeks.

Rehabilitation strategies

Plyometric exercises are a central element of this phase, they allow the subject to work on the load, on the endurance and on the strength and on the muscle control.

At the end of this phase, the patient can return to non-competitive sports at low load (swimming or cycling). The return to sporting activity is granted after 3-4 months in the absence of risk factors.

Precautions

In the first phase (first 2 weeks) some precautions may be taken in consideration and the following movements are considered more at risk: flexion associated with internal rotation, flexion more than 90°, active flexion of the hip with knee extended

Some clinical conditions like suture of the acetabular labrum may delay or influence this rehabilitation program (Table1, Figure 3).

Results

Pre-operative evaluation: each patient was evaluated a few days before surgery to record the initial assessment and to provide indications on post-surgical management.

Beginning of rehabilitation treatment: patient rehabilitation begins between 1 and 3 post-operative days.

Duration and frequency of rehabilitation treatment: the mean duration of rehabilitation treatment was 41±7.3 days, corresponding to approximately 6 weeks. The average number of sessions was 19±3.8 with an average weekly frequency of one session every 2.2±0.5 day. The single session lasted between 60 and 90 minutes.

Assessment outcomes: pain trend, changes in daily life activities, changes in the outcome of specific clinical tests, changes in the joint kinematics of the operated hip.

Pain

Six weeks after surgery T0 and T1, there is a pain reduction of 36.04%, while at the 3-month follow-up the reduction is 33.44%. Therefore, as regards the aspect of pain, the surgical and rehabilitative treatment had a good outcome (Table 2).

Table 1. Proposals and rehabilitation strategies for each phase of treatment

	Phase I	**Phase II**	**Phase III**
	(0-2 weeks)	**(2-4 weeks)**	**(4-6 weeks)**
Rehabilitation	Passive and active-assisted mobilization	Passive and active mobilization of the hip	Capsular stretching
	Isometric contraction exercises of the lower limb	Bi- and monopodalic propioceptive exercises	Manual terapy
	Closed kinetic chain exercises with Fit ball	Rotational exercises	Plyometric exercises with mini-trampoline
	Cycle ergometer without resistance (hip flexion <90°)	Cycle ergometer with moderate resistance	Muscle reinforcement with elastic
	Pelvis and lumbar spine mobilization with Fit ball	Muscolar stretching	Cycle ergometer with intense resistance
	Core-stability exercises	Core-stability exercises	Squat
	Bi- and monopodalic proprioceptive protected exercises	Gait exercises	Propioception
	Research of muscle elasticity of hip flexors and extensors		Walk on treadmill
	Gait normalization		Bi- and monopodalic leg-press
	(80% immersion)	**(50-80% immersion)**	
Hydro-kinesitherapy	Active hip mobilization	Dynamic exercises in standing, squats and steps	
	Exercises for the recovery of strength and muscle control with floats	Active mobilization with particular focus on rotations	
	Walk	Walk	
	Mini squat and step	Swimming (also with fins or board)	

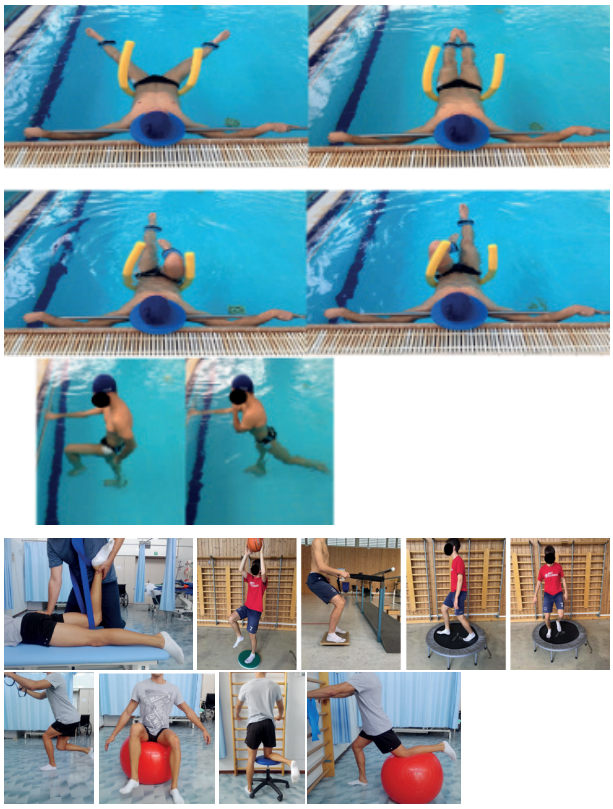

Figure 3. Explanatory pictures

Function

The table shows the differences in the mean values of the WOMAC scale of all patients, there is a improvement in functionality of 44.68% between T0 and T1, and of 44.33% between T0 and T2. Both data are statistically significant (p-value (T1-T0) = 0.0219, p-value (T2-T0) = 0.0227). Therefore, according to the scores recorded by the WOMAC scale, an evident improvement in the activities of daily living and general performance was recorded after surgery and rehabilitation (Table 3).

Table 2. VAS score T0=pre-operative, T1=6 weeks of follow-up (end of the rehabilitative treatment), T2=3 month of follow-up

VAS score				
average±d.s			**difference**	**%**
T1 – T0	2,19±2,6	3,4±2,5	-1,23±3,23	-36,04%
T2 - T0	2,3±2,2	3,4±2,5	-1,14±2,86	-33,44%

Table 3. WOMAC score

WOMAC score				
averege±d.s			**difference**	**%**
T1-T0	16,42±2,5	29,7±2,5	-13,26±23	-44,68%
T2-T0	16,52±2,1	29,7±2,5	-13,15±23	-44,33%

Range of Motion

From T0-T1
3.6°±10.6° increase in flexion knee flexion (LS);
10.9°±20° increase in flexion with knee extended (LS);
1.3°±5.9° increase in hip extension (NS);
2.2°±17.7° increase in hip abduction (NS
6.8°±9.8° increase in hip adduction (AS);
5.2°±7.2° increase in extra hip rotation (AS)
Increase of 8.7°±9.3° of intra hip rotation (AS);
From T0 to T2:
8.7°±11.4° increase in flexion knee flexion (AS);
11.3°±19.5° increase in knee flexion (MS);

Table 4. Range of motion

	average (°)			**Difference** (°)		
	T0	**T1**	**T2**	**T1-T0**	**P-value**	**T2-T0**
Flexion with flexed knee	105,6±15,6	111,9±10,4	114,3±12,2	3,6±10,6	0,0508	8,7±11,4
Flexion with extended knee	85±17,4	95,5±18,1	96,2±19,6	10,9±20	0,0306	11,3±19,5
Extension	31,5±7,1	32,7±9,4	36,3±9,7	1,3±5,9	0,3657	4,8±7,3
Abduction	50±14,5	52,1±13,9	53±15,1	2,2±17,7	0,6026	2,3±16,5
Adduction	28±8,6	35±7,6	34,8±10,2	6,8±9,8	0,0068	6,6±10,8
External rotation	35,1±8,9	40,3±8,3	38±9,4	5,2±7,2	0,0055	2,9±8,8
Internal rotation	32,2±8,6	41,2±11,1	38,4±9,9	8,7±9,3	0,0005	6,11±8,2

4.8°±7.3° increase in hip extension (MS);
2.3°±16.5° increase in hip abduction (NS);
6.6°±10.8° increase in hip adduction (MS);
2.9°±8.8° increase in extra hip rotation (NS);
6.11°±8.2° increase in intra hip rotation (AS) (Table 4).

Discussion

The sample of this study was composed of 19 patients, 12 males, 7 females with mean age 37±8.3 years who underwent arthroscopic treatment for femoroacetabular impingement and subsequent physiotherapy.

The analysis of the VAS score shows a reduction in pain between the pre-operative evaluation (T0) and the first evaluation after 6 weeks (T1) of 1.23±3.23 points, which is equivalent to a decrease in the symptom of 36%.

The pain score is in line with other studies in literature that show an average reduction in the VAS scores (26, 27)

Pain assessment at follow-up between T0 and T2 reports an average reduction of 33% (-1.14±2.86 points).

Regardless of the data found, the results obtained are not statistically significant, and these considerations are subject to different interpretations.

It must be said that pain is a subjective experience and is difficult to compare between the various subjects.

With regard to the study of functionality expressed through the WOMAC score, before the intervention (T0) the overall average of the subjects corresponded to 29.7±2.5 points, while at 6 weeks 16.42±2.5. This confirms a 44.68% reduction in the score and therefore an increase in function and performance, similarly the same thing happens between the preoperative phase and after 3-month of follow-up (the mean of the WOMAC score is reduced by 13, 15 points and therefore the performance measurement index increased by 44.33%). The values from T0 to T1 and from T0 to T2 are related to a very low p-value (<0.05), therefore statistically significant. This result agrees with the literature regarding the improvement of global functionality and the return of activities of daily life (26, 27).

The last aspect, fundamental for the evaluation of femoral-acetabular impingement, is the range of motion, indeed the literature correlates this pathology with the reduction of the hip range of motion (28). Using the inertial sensor system (The BioVal® system), the active movements of the pathological hip were evaluated in flexion with flexed and extended knee (supine patient); extension (prone patient); abduction-adduction (supine patient); external rotation-internal rotation (patient seated). An increase in range of motion was found for each movement.

The analysis of the range motion between T1 and T0 reveals important results also from a statistical point of view in most of the movements. In fact, range of motion increases are recorded for all axes of motion (with the exception of extension and abduction). Joint evaluations at follow-up show that there is an increase in range of motion, in particular in flexion movements with knee flexed 8.7°±11.4° and internal rotation of the hip 6.11°±8.2° (highly significant values).

Conclusions

The analysis of the outcomes examined in this study allows us to state that:

- in subjects undergoing femoroacetabular impingement surgery and post-operative rehabilitation treatment, the pain is reduced on average by 36% at 6 weeks and by 33% at 3 months; however, this remains an individual element and subject to different interpretations.
- the functionality and performance of the activities of daily living improve considerably after the surgical-rehabilitation with favourable outcomes both at 6 weeks and 3 months after surgery (the average scores on the WOMAC score allow us to state that there is an overall increase in performance equal to 44%)
- the range of movement of the patients at 6 weeks and 3 months registers a significant increase in active movement in all directions, particularly in the movements most affected by the femoroacetabular impingement, such as flexion and internal rotation (28).
- the proposal of a rehabilitation treatment with the characteristics of: earliness, intensity of frequency,

integration of hydro-kinesitherapy, exercise and manual therapy (multimodal modality) seems to respond positively to the needs of patients undergoing surgery for femoroacetabular impingement.
This protocol, based on the results obtained, seems to guarantee good results (in line with the literature), however it requires further experimentation and investigation considering the size of the sample.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article. Ethics committee approval was not required for the retrospective nature of the present study.

References

1. Ganz R, Leunig M, Leunig-Ganz K, Harris WH. The etiology of osteoarthritis of the hip: an integrated mechanical concept. Clin Orthop Relat Res 2008;466(2):264-72.
2. Myers SR, Eijer H, Ganz R. Anterior femoroacetabular impingement after periacetabular osteotomy. Clin Orthop Relat Res 1999(363):93-9.
3. Ganz R, Parvizi J, Beck M, Leunig M, Notzli H, Siebenrock KA. Femoroacetabular impingement: a cause for osteoarthritis of the hip. Clin Orthop Relat Res 2003(417):112-20.
4. Tibor LM, Leunig M. The pathoanatomy and arthroscopic management of femoroacetabular impingement. Bone Joint Res 2012;1(10):245-57.
5. Sankar WN, Matheney TH, Zaltz I. Femoroacetabular impingement: current concepts and controversies. Orthop Clin North Am 2013;44(4):575-89.
6. Pun S, Kumar D, Lane NE. Femoroacetabular impingement. Arthritis Rheumatol 2015;67(1):17-27.
7. Amanatullah DF, Antkowiak T, Pillay K, et al. Femoroacetabular impingement: current concepts in diagnosis and treatment. Orthopedics 2015;38(3):185-99.
8. Imam S, Khanduja V. Current concepts in the diagnosis and management of femoroacetabular impingement. Int Orthop 2011;35(10):1427-35.
9. Sangal RB, Waryasz GR, Schiller JR. Femoroacetabular impingement: a review of current concepts. R I Med J (2013) 2014;97(11):33-8.
10. Enseki K, Harris-Hayes M, White DM, et al. Nonarthritic hip joint pain. J Orthop Sports Phys Ther 2014;44(6):A1-32.
11. Thomas GE, Palmer AJ, Andrade AJ, et al. Diagnosis and management of femoroacetabular impingement. Br J Gen Pract 2013;63(612):e513-5.
12. Reiman MP, Goode AP, Cook CE, Holmich P, Thorborg K. Diagnostic accuracy of clinical tests for the diagnosis of hip femoroacetabular impingement/labral tear: a systematic review with meta-analysis. Br J Sports Med 2015;49(12):811.
13. Di Benedetto P, Zangari A, Giardini P, Mancuso F, Castriotta L, Causero A. Capsular closure after hip arthroscopy: our experience. Acta Biomed 2020;91(4-S):92-7.
14. Di Benedetto P, Zangari A, Mancuso F, Buttironi MM, Causero A. Capsular management in the arthroscopic treatment of the femoro-acetabular impingement in athletes: our experience. Acta Biomed 2020;91(14-S):e2020023.
15. Palmer AJ, Ayyar-Gupta V, Dutton SJ, et al. Protocol for the Femoroacetabular Impingement Trial (FAIT): a multicentre randomised controlled trial comparing surgical and non-surgical management of femoroacetabular impingement. Bone Joint Res 2014;3(11):321-7.
16. Harris JD, Erickson BJ, Bush-Joseph CA, Nho SJ. Treatment of femoroacetabular impingement: a systematic review. Curr Rev Musculoskelet Med 2013;6(3):207-18.
17. Bennell KL, O'Donnell JM, Takla A, et al. Efficacy of a physiotherapy rehabilitation program for individuals undergoing arthroscopic management of femoroacetabular impingement - the FAIR trial: a randomised controlled trial protocol. BMC Musculoskelet Disord 2014;15:58.
18. Edelstein J, Ranawat A, Enseki KR, Yun RJ, Draovitch P. Post-operative guidelines following hip arthroscopy. Curr Rev Musculoskelet Med 2012;5(1):15-23.
19. Grzybowski JS, Malloy P, Stegemann C, Bush-Joseph C, Harris JD, Nho SJ. Rehabilitation Following Hip Arthroscopy - A Systematic Review Front Surg. 2015;2:21.
20. Kemp JL, Moore K, Fransen M, Russell TG, Crossley KM. A phase II trial for the efficacy of physiotherapy intervention for early-onset hip osteoarthritis: study protocol for a randomised controlled trial. Trials 2015;16:26.
21. Malloy P, Malloy M, Draovitch P. Guidelines and pitfalls for the rehabilitation following hip arthroscopy. Curr Rev Musculoskelet Med 2013;6(3):235-41.
22. Spencer-Gardner L, Eischen JJ, Levy BA, Sierra RJ, Engasser WM, Krych AJ. A comprehensive five-phase rehabilitation programme after hip arthroscopy for femoroacetabular impingement. Knee Surg Sports Traumatol Arthrosc 2014;22(4):848-59.
23. Wahoff M, Dischiavi S, Hodge J, Pharez JD. Rehabilitation after labral repair and femoroacetabular decompression: criteria-based progression through the return to sport phase. Int J Sports Phys Ther 2014;9(6):813-26.
24. Griffin DR, Dickenson EJ, O'Donnell J, et al. The Warwick Agreement on femoroacetabular impingement syndrome (FAI syndrome): an international consensus statement. Br J Sports Med 2016;50(19):1169-76.
25. Di Benedetto P, Barbattini P, Povegliano L, et al. Extracapsular vs standard approach in hip arthroscopy. Acta Biomed 2016;87 Suppl 1:41-5.
26. Tijssen M, van Cingel R, de Visser E, Nijhuis-van der Sanden M. A clinical observational study on patient-reported outcomes, hip functional performance and return to sports activities in hip arthroscopy patients. Phys Ther

Sport 2016;20:45-55.
27. Polat G, Dikmen G, Erdil M, Asik M. Arthroscopic treatment of femoroacetabular impingement: early outcomes. Acta Orthop Traumatol Turc 2013;47(5):311-7.
28. Diamond LE, Dobson FL, Bennell KL, Wrigley TV, Hodges PW, Hinman RS. Physical impairments and activity limitations in people with femoroacetabular impingement: a systematic review. Br J Sports Med 2015;49(4):230-42.

Received: 10 December 2021
Accepted 18 January 2022
Correspondence:
Paolo Di Benedetto, MD, PhD
Clinic of Orthopedics
ASUFC – Academic Hospital of Udine
P.le S.Maria della Misericordia, 15 - 33100 Udine, Italy
Tel. +39 0432 559464 - Fax +39 0432 559298
E-mail: paolo.dibenedetto@uniud.it