The clinical outcomes of arthroscopic hip labral repair: a comparison between athletes and non-athletes

Huan Sheu\textsuperscript{1,2,3}, Tien-YU Yang\textsuperscript{3,4}, Hao-Che Tang\textsuperscript{3,5}, Chen-Te Wu\textsuperscript{3,6}, Alvin Chao-Yu Chen\textsuperscript{1,2,3} and Yi-Sheng Chan\textsuperscript{1,2,3*}

\textsuperscript{1}Department of Orthopedic Surgery, Chang Gung Memorial Hospital, No. 5, Fuxing St., Guishan Dist., Taoyuan 333, Taiwan (R.O.C.), \textsuperscript{2}Bone and Joint Research Center, Chang Gung Memorial Hospital, No. 5, Fuxing St., Guishan Dist., Taoyuan 333, Taiwan (R.O.C.), \textsuperscript{3}Bone and Joint Research Center, Chang Gung Memorial Hospital, No. 5, Fuxing St., Guishan Dist., Taoyuan 333, Taiwan (R.O.C.), \textsuperscript{4}Comprehensive Sports Medicine Center, Chang Gung Memorial Hospital, No. 5, Fuxing St., Guishan Dist., Taoyuan 333, Taiwan (R.O.C.), \textsuperscript{5}Department of Orthopedic Surgery, Chang Gung Memorial Hospital, No. 8, Sec. W., Jiapu Rd., Puzi, Chia-yi 613016, Taiwan (R.O.C.), \textsuperscript{6}Department of Orthopedic Surgery, Chang Gung Memorial Hospital, No. 241, Majin Rd., Anle Dist., Keelung 204011, Taiwan (R.O.C.) and \textsuperscript{7}Department of Medical Imaging and Intervention, Chang Gung Memorial Hospital, No. 5, Fuxing St., Guishan Dist., Taoyuan 333, Taiwan (R.O.C.)

This paper has been presented at 2018 October ISHA meeting in Melbourne, Australia. No benefits in any form have been received or will be received from a commercial party directly or indirectly related to the subject of this article.

*Correspondence to: Y. S. Chan. E-mail: yschan512@gmail.com

ABSTRACT

The objective of this study is to compare the clinical outcomes after arthroscopic hip labral repair in athletes and non-athletes. The design of this study is a retrospective comparative study. The setting of this study is an institutional study. One hundred and sixty patients of hip labral tears who underwent arthroscopic labral repair were included. Eighty-five of these patients met the inclusion/exclusion criteria (25 athletes and 60 non-athletes). Hip labral tears underwent arthroscopic labral repair. The main outcome measures are as follows: visual analog scale (VAS) and modified Harris Hip Score (mHHS) 2 years postoperatively and the rate of return to sports at present level. There was no significant difference in the gender, alpha angle, lateral center-edge angle between the two groups, except for the mean age (19.3 versus 42.2, \( P < 0.001 \)), Marx activity rating scale (MARS) (14.6 versus 6.8, \( P < 0.001 \)) and University of California, Los Angeles (UCLA) activity rating scale (9.6 versus 5.0, \( P < 0.001 \)). The intraoperative findings were similar in the two groups. The VAS scores and mHHS both showed a significant improvement after surgery in both groups (VAS improvement 3.6 and mHHS improvement 22.4 in the athlete group; VAS improvement 3.9 and mHHS improvement 25.0 in the non-athlete group, all \( P < 0.001 \)). There was no difference in VAS improvement or mHHS improvement between the athlete and non-athlete groups. All the patients in the athlete group return to sports at previous level 6 months after the operation. The mean time of return to sports at previous level was 5.4 months. Both athletes and non-athletes demonstrate significant VAS and mHHS improvement following arthroscopic labral repair. The VAS scores improvement and mHHS improvement were similar in the athlete and non-athlete groups after arthroscopic labral repair.

INTRODUCTION

Labral tears have been associated with hip pain in athletes [1]. Some specific sports may predispose athletes to extreme range of hip motion, pivoting on a loaded femur (dancers and gymnasts), repetitive impact loads (soccer, lacrosse, and track and field), or colliding with other athletes, and sustaining hip injury due to acute trauma [2]. Femoroacetabular impingement (FAI) is now recognized as a common cause of hip pain and intra-articular disorders in athletes. Current theories suggest that repetitive axial loading or hip flexion may stimulate anterolateral extension of the physis, resulting in the bony overgrowth of the cam deformity [3]. Among patients younger than 30 years, 70% of FAI cases were related to athletic activity [4]. More recently, Byrd JWT et al. reported that 96% of adolescents with FAI participated in athletic activity, which was significantly higher than the rate observed in an adult control group [5].

Some studies showed the significant success of arthroscopic treatment with labral repair. Also, in the recent studies, the clinical results of arthroscopic labral repair in the general population showed favorable clinical improvements on patient-reported outcomes [6, 7]. However, there was limited data comparing the clinical outcomes of arthroscopic labral repair in patients with sports injury and non-sports injury. Furthermore, it was difficult to differentiate whether the hip labral tear was caused by sports injury or non-sports injury. Hence the purpose of this study was to compare the clinical outcomes of arthroscopic labral repair in the athlete group (sports injury group) and the non-athlete group (non-sports injury group).
We hypothesized that the athlete group with symptomatic labral tear may benefit from arthroscopic labral repair, similar to the non-athlete group.

**MATERIAL AND METHODS**

We performed a retrospective comparative study comprised of patients with hip labral tears who underwent arthroscopic labral repair from April 2010 to October 2016 in our institute, excluding patients with advanced osteoarthritis (OA) (Tonnis grade ≥2), frank developmental dysplastic hips (DDH) (lateral center-edge angle [LCEA] <20 degrees), tumor, such as synovial chondromatosis, or hyperlaxity. We used the Marx activity rating scale (MARS) [8] and UCLA activity rating scale [9] to assess the physical activity in their healthiest and most active state in the past year, which helps to divide patients into athlete group and non-athlete group. The MARS lists four items: running, cutting, decelerating and pivoting, ranging from 0 to 16, indicating how often the patient performed each activity. Although the MARS was developed as a knee-specific functional measure, the questions appear to be relevant to hip pain. The UCLA provides descriptive activity levels ranging from 1 to 10, where 1 is defined as wholly inactive and dependent on others and 10 is defined as regularly participating in impact sports such as jogging, tennis and skiing.

All of the patients had one or more of the following symptoms: pain in the anterior hip or groin; pain during ambulation or long period of sitting; or a clicking sensation in the hip joint [10]. Positive signs during physical examination included forced flexion combined with internal rotation or abduction combined with external rotation. Sometimes these movements will produce an accompanying click or pain [11]. The anteroposterior pelvis, false profile, cross-table lateral view and Dunn view radiographs are routinely used to assess our patients. The LCEA is measured using the anteroposterior radiograph, whereas the alpha angle is measured using the Dunn view for assessing the cam deformity [12, 13]. Magnetic resonance arthrography (MRA) is routinely used to assess soft tissues including the acetabular labrum, articular surfaces, ligamentum teres, capsule and surrounding musculature. All patients had undergone failed conservative treatment before arthroscopy, including nonsteroidal anti-inflammatory medications, physical therapy and partial weight-bearing with crutches. Patients with positive MRA findings with a symptomatic hip were recommended to undergo arthroscopic hip surgery.

**Arthroscopic hip procedure**

Arthroscopy was performed in the supine position as described by J.W.T. Byrd [14]. Traction was applied to the operative extremity, and hip joint distraction was confirmed by fluoroscopic examination. The senior surgeon used two portals (anterior or anterolateral portals) or three portals (additional posterolateral portal). These were adapted from the description by Glick et al. in 1987 [15]. Minimal capsulotomy without capsule repair would be done if no peri-operative hyperlaxity existed.

Assessment of intra-articular structures was performed under direct arthroscopic visualization. The location of labral tear was recorded and the tear type was assessed according to Seldes classification [16]. The chondral injury was assessed by using Outerbridge classification [17]. The ligamentum teres injury was assessed using a descriptive classification system (grade 0: no tear, grade 1: <50% tear, grade 2: >50% tear, grade 3: complete tear) [18]. These labral tears were repaired with a bioresorbable suture anchor. The number of suture anchors used depended on the size of the labral tear lesion, one per centimeter of lesion. A pierced suture technique was performed if the tissue was adequate, involving passing one or both of the suture limbs through the labral tissue in a mattress fashion. If there was not enough tissue, a looped suture configuration provides a strong fixation by passing the limbs in a circumferential manner around the labral tissue to secure it to the acetabular rim [19]. Acetabuloplasty of the acetabular rim for pincer impingement or femoroplasty of the bony prominence at the junction of the femoral head and neck for cam impingement was performed in the setting of FAI. All surgeries were performed by the same senior surgeon.

**Postoperative rehabilitation**

The patients were instructed to bear weight with a crutch or walker and avoid internal or external rotation over 30 degrees or flexion over 90 degrees for the first 6 weeks. Early range-of-motion exercises were encouraged to prevent soft tissue adhesions and promote early recovery. Full strength and activity were allowed at 3 months, and return to sports was allowed at 6 months.

**Outcome measures**

The visual analog scale (VAS) for pain and modified Harris Hip Score (mHHS) for functional outcomes were assessed preoperatively and 2 years postoperatively [20]. The rate of return to sports at previous level 6 months postoperatively in the athlete group was also recorded.

These patients were divided into two groups. The athlete or sports injury group, consisting of elite, professional or school athletes, with MARS ≥12 and UCLA activity rating scale ≥8, may imply the labral tears can be attributed to a specific sport-related traumatic event. The non-athlete or non-sports injury group, including patients with MARS <12 or UCLA activity rating scale <8, and the labral tears were related to other non-sports etiology. Demographic and outcome measures were compared between the two groups.

**Statistical analysis**

The t-test and chi-square test were used to evaluate group differences in demographic characteristics. The independent t-test was used to evaluate group differences of VAS and mHHS in study measures at preoperatively and 2 years postoperatively. A P-value <0.05 was regarded as significant. All statistical analyses were performed using SAS version 9.2 (SAS Institute Inc., Cary, NC, USA) and Microsoft Excel 2017 software.

**RESULTS**

A total of 116 consecutive patients were included in this study (Fig. 1). We excluded 31 patients with follow-up time <2 years (n = 15), incomplete data (n = 10), frank DDH (n = 1), advanced OA (n = 3) and synovial chondromatosis (n = 2). No hyperlaxity was found. A total of 85 patients were reviewed and
Table I. The sports category in athlete group and the etiology in non-athlete group

| Category                   | Number |
|----------------------------|--------|
| Athletes group             | 25     |
| Ballet                     | 15     |
| Basketball                 | 4      |
| Badminton                  | 3      |
| Boat rower                 | 3      |
| Non-athletes group         | 60     |
| Trauma                     | 10     |
| Borderline DDH             | 7      |
| Tonnis grade I OA          | 7      |
| FAI                        | 35     |

divided into the athlete group and non-athlete group according to the MARS and UCLA activity scale. The mean follow-up time was 38.3 ± 10.5 months (range, 25.2–54.6 months). Twenty-five patients were in the athlete group, including 15 ballet dancers, 4 basketball players, 3 badminton players and 3 boat rowers. Sixty patients were in the non-athlete group, including 10 patients with trauma, 7 patients with borderline DDH (LCEA of 20 to 25 degrees), 7 patients with Tonnis grade I OA and 35 patients with FAI (Table I). According to the demographic data (Table II), the age of the athlete group was younger than non-athlete group (19.3 versus 42.2, P < 0.001). The athlete group had significantly higher preoperative physical activity than that of the non-athlete group (MARS: 14.6 versus 6.8, P < 0.001, UCLA scale: 9.6 versus 5.0, P < 0.001). There was no significant difference in the gender, alpha angle and LCEA between the two groups. Regarding the intraoperative findings, the labral tears were all located at the anterosuperior site and the tear types were similar in the two groups. The prevalence of FAI, chondral injury and ligamentum teres tear rates was equivalent in the two groups. The VAS scores and mHHS both showed a significant improvement after surgery in both groups (VAS improvement 3.6 and mHHS improvement 22.4 in the athlete group; VAS improvement 3.9 and mHHS improvement 25.0 in the non-athlete group, all P < 0.001). There was no difference in the preoperative, postoperative VAS, VAS improvement or mHHS improvement between the athlete and non-athlete groups (Table III). However, the athlete group had higher preoperative and postoperative mHHSs (preoperative: 61.0 versus 52.3, P = 0.02; postoperative: 83.4 versus 76.5, P = 0.03). All the patients in the athlete group returned to sports at previous level 6 months after the operation. The mean time of return to sports at previous level was 5.4 months.

DISCUSSION

The purpose of this study was to compare the differences in clinical and functional outcomes after arthroscopic hip labral repair between the athlete and non-athlete groups. The current study showed that the athlete and non-athlete groups both achieved significant improvement in VAS scores and mHHS after arthroscopic labral repair. The VAS scores improvement and mHHS improvement were similar in the two groups after arthroscopic labral repair.
Similar to our study, some studies showed promising outcomes for hip arthroscopic surgery in patients with sports injuries. Mohan et al. [21] reported a minimum 2-year follow-up of 50 young amateur athletes treated by arthroscopic labral repair. The mHHS improved from 63.6 to 84.8 points, the hip outcome score (HOS) of activity daily living and sport increased from 78.1 to 91.3 and from 43.7 to 80.1, and the return to sports rate was 92%. Ramos et al. [22] demonstrated that all the elite-level water polo players who underwent hip arthroscopy for FAI returned to the same level of play and were highly satisfied. Sochacki et al. [23] reported the return to sports rate for National Hockey League athletes after hip arthroscopy is above 90% at less than 1 year, without a significant decrease in postoperative performance. On the other hand, some literature also showed the good results of hip arthroscopic management in patients with non-sports injury. Kamath et al. [6] evaluated 52 patients with a mean age of 42 years who underwent arthroscopic labral repair, with a mean follow-up period of 58 months. The good or excellent outcome was 56–66% and 84% of patients were able to return to sports. Ben Tov et al. [6] reported a case series of 20 patients aged older than 50 years who had undergone arthroscopic repair with a mean follow-up period of 22 months. The mHHS improved from 62.5 to 87.2 points, the HOS increased from 52.7 to 82.3 and the return to sports rate was 92%. The authors advocated repair of the labrum in patients aged older than 50 years when possible.

In the current study, the VAS scores improvement and mHHS improvement were similar in athlete and non-athlete groups after arthroscopic labral repair. It is not surprising that preoperative and postoperative mHHSs were higher in the athlete group, because they were younger and had better physical activity levels. Labral tears in athletes can result from isolated athletic injury events or repetitive traumatic activity, and athletes can be predisposed to injury by FAI and developmental abnormalities [24]. Philippon et al. [25] reported that FAI was more prevalent in athletes than in non-athletes, leading to more hip labral tears. FAI accounts for 73% of Korean athletes with hip labral tears and mostly presents as the degenerative type [26]. However, Jonasson et al. found no differences in cam morphology between top-level athletes (ice-hockey and soccer players) and non-athletes [27]. In the current study, the prevalence of FAI was higher in the sports group (87.5%) than in the non-sports group (58.3%), although the difference was not significant.

Ballet dancing is one of the sports requiring frequent external rotation and has been linked to labral abnormalities [2, 24, 28–30]. Furthermore, the repetitive torsional loading of the hip joint in extreme ranges of motion while performing ballet movements, along with FAI and subluxation due to capsular laxity, puts ballet dancers at risk of hip labral tear [31, 32]. In our study, ballet dancing was the most common sport among the athlete group. Although no hyperlaxity was found in our series, the capsule should be managed cautiously to avoid peri-operative instability.

### Limitations

There were limitations in this study. First, the main limitation of this retrospective study was the limited number of participants. Second, the athletes and non-athletes were not matched for labral tears and method of repair. Third, the current study was a retrospective review of a heterogeneous patient population and different sports athletes, which might have biased and confounded the results.

### CONCLUSION

Both athletes and non-athletes demonstrate significant VAS and mHHS improvement following arthroscopic labral repair and

---

**Table II. Demographic, radiographic data and intraoperative finding for the athlete group and non-athlete injury group**

| Demographic data | Athletes (n = 25) | Non-athletes (n = 60) | P-value |
|------------------|-------------------|-----------------------|---------|
| Age (years)      | 19.3 ± 6.8        | 42.2 ± 5.4            | <0.001  |
| Gender (M:F)     | 6:19              | 30:30                 | 0.41    |
| Marx activity rating scale | 14.6 ± 1.9 | 6.8 ± 1.4 | <0.001  |
| UCLA activity rating scale | 9.6 ± 0.7 | 5.0 ± 1.3 | <0.001  |
| Radiographic data |                   |                       |         |
| Alpha angle (degrees) | 63.6 ± 9.8 | 60.2 ± 3.3 | 0.35    |
| Center-edge angle (degrees) | 32.0 ± 5.6 | 34.7 ± 4.5 | 0.51    |
| Intraoperative finding |               |                       |         |
| Operative traction time (min) | 66.6 ± 18.9 | 69.9 ± 10.2 | 0.72    |
| Labrum tear       | 25 (100%)         | 60 (100%)             | 1.00    |
| Seldes I:II       | 16:9              | 38:22                 |         |
| Location          | AS (100%)         | AS (100%)             |         |
| FAI               | 87.5% (22)        | 58.3% (35)            | 0.21    |
| Cam-pincer:mixed  | 11:1:10           | 19:1:15               |         |
| Chondral injury   | 37.5% (9)         | 41.7% (25)            | 1.00    |
| Grade I:II:III:IV | 6:3:0:0           | 15:9:1:0              |         |
| Ligamentum teres tear | 25.0% (6) | 16.7% (10) | 0.62    |
| Grade I:II:III    | 6:0:0             | 9:1:0                 |         |

M, male; F, female; AS, anterosuperior.

**Table III. The preoperative and postoperative VAS scores and mHHSs for the athlete group and non-athlete group**

|                      | Athletes (n = 25) | Non-athletes (n = 60) | P-value |
|----------------------|-------------------|-----------------------|---------|
| VAS                  |                   |                       |         |
| Pre-op               | 5.6 ± 1.6         | 5.4 ± 1.2             | 0.695   |
| Post-op              | 1.8 ± 0.7         | 1.9 ± 0.7             | 0.659   |
| VAS improvement      | 3.6 ± 1.6         | 3.9 ± 1.4             | 0.692   |
| P-value              | <0.001            | <0.001                |         |
| mHHS                 |                   |                       |         |
| Pre-op               | 61.0 ± 5.0        | 52.3 ± 8.8            | 0.020   |
| Post-op              | 83.4 ± 3.7        | 76.5 ± 5.6            | 0.030   |
| mHHS improvement     | 22.4 ± 3.6        | 25.0 ± 8.8            | 0.417   |
| P-value              | <0.001            | <0.001                |         |

Pre-op, preoperative; Post-op, postoperative.
management of FAI. The VAS scores improvement and mHHS improvement were similar in athlete and non-athlete groups after arthroscopic labral repair.

DATA AVAILABILITY
The data used to support the findings of this study are included within the article.

ACKNOWLEDGEMENTS
This study did not receive any financial support from any institution.

FUNDING
No funding was received for this study.

CONFLICT OF INTEREST STATEMENT
None declared.

REFERENCES
1. Cianci A, Sugimoto D, Stracciolini A et al. Nonoperative management of labral tears of the hip in adolescent athletes. Clin J Sport Med 2019; 29: 24–8.
2. Lewis CL, Sahrmann SA. Acetabular labral tears. Phys Ther 2006; 86: 110–21.
3. Nepple JJ, Vigdorich JM, Clohisy JC. What is the association between sports participation and the development of proximal femoral cam deformity? Am J Sports Med 2015; 43: 2833–40.
4. Byrd JWT, Jones KS, Gwathmey FW. Femoroacetabular impingement in adolescent athletes: outcomes of arthroscopic management. Am J Sports Med 2016; 44: 2106–11.
5. Byrd JWT, Jones KS, Gwathmey FW. Arthroscopic management of femoroacetabular impingement in adolescents. Arthroscopy 2016; 32: 1800–6.
6. 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.
7. Ben Tow T, Amar E, Sharipa A et al. Clinical and functional outcome after acetalabular labral repair in patients aged older than 50 years. Arthroscopy 2014; 30: 305–10.
8. Marx RG, Stump TJ, Jones EC et al. Development and evaluation of an activity rating scale for disorders of the knee.pdf. Am J Sports Med 2001; 29: 213–8.
9. Zahiri CA, Schmalfried TP, Szuszczeiwicz ES et al. Assessing activity in joint replacement patients. J Arthroplasty 1998; 13: 890–5.
10. Chan Y-S, Lien L-C, Hsu H-L et al. Evaluating hip labral tears using magnetic resonance arthrography: a prospective study comparing hip arthroscopy and magnetic resonance arthrography diagnosis. Arthroscopy 2005; 21: 1250–e1.
11. Thomas Byrd JW, Jones KS. Hip arthroscopy in athletes. Am J Sports Med 2009; 37: 2140–3.
12. Perets I, Hartigan DE, Chaharbakhshi EO et al. Outcomes of hip arthroscopy in competitive athletes. Arthroscopy 2017; 33: 1521–9.
13. Noottzli 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.
14. Byrd JWT. Hip arthroscopy utilizing the supine position. Arthroscopy 1994; 10: 275–80.
15. Glick JM, Sampson TG, Gordon RB et al. Hip arthroscopy by the lateral approach. Arthroscopy 1987; 3: 4–12.
16. Seldes RM, Tan N, Hunt J et al. Anatomy, histologic features, and vascularity of the adult acetabular labrum. Clin Orthop Relat Res 2001; 382: 232–40.
17. Outerbridge RE. The etiology of chondromalacia patellae. J Bone Joint Surg 1961; 43–B: 752–7.
18. Botser IB, Martin DE, Stout CE et al. Tears of the ligamentum teres. Am J Sports Med 2017; 39: 117–25.
19. 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.
20. Aprato A, Jayasekera N, Villar RN. Does the modified Harris Hip Score reflect patient satisfaction after hip arthroscopy? Am J Sports Med 2012; 40: 2557–60.
21. Mohan R, Johnson NR, Hevesi M et al. Return to sport and clinical outcomes after hip arthroscopic labral repair in young amateur athletes: minimum 2-year follow-up. Arthroscopy 2017; 33: 1679–84.
22. Ramos N, Yousefzadeh K, Gerhardt M et al. Results of hip arthroscopy in elite level water polo players with femoroacetabular impingement: return to play and patient satisfaction. J Hip Preserv Surg 2020; 7: 116–21.
23. Sochacki KR, Jack RA, Hirase T et al. Performance and return to sport after hip arthroscopy for femoroacetabular impingement syndrome in National Hockey League players. J Hip Preserv Surg 2019; 6: 234–40.
24. Bharam S. Labral tears, extra-articular injuries, and hip arthroscopy in the athlete. Clin Sports Med 2006; 25: 279–92.
25. Philippon MJ, Nepple JJ, Campbell KJ et al. The hip fluid seal—part I: the effect of an acetabular labral tear, repair, resection, and reconstruction on hip fluid pressurization. Knee Surg, Sports Traumatol Arthrosc 2014; 22: 722–9.
26. Kang C, Hwang D-S, Cha S-M. Acetabular labral tears in patients with sports injury. Clin Orthop Surg 2009; 1: 230.
27. Jonasson P, Thoresen O, Sansone M et al. The morphologic characteristics and range of motion in the hips of athletes and non-athletes. J Hip Preserv Surg 2016; 3: 325–32.
28. Groh MM, Herrera J. A comprehensive review of hip labral tears. Curr Rev Musculoskelet Med 2009; 2: 105–17.
29. Mason JB. Acetabular labral tears in the athlete. Clin J Sport Med 2001; 20: 779–90.
30. Binningsley D. Tear of the acetabular labrum in an elite athlete. Br J Sports Med 2003; 37: 84–8.
31. Mayes S, Ferris A-R, Smith P et al. Similar prevalence of acetabular labral tear in professional ballet dancers and sporting participants. Clin J Sport Med 2015; 26: 307–13.
32. Charbonnier C, Kolo FC, Duthon VB et al. Assessment of congruence and impingement of the hip joint in professional ballet dancers. Am J Sports Med 2010; 39: 557–66.