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Research article

Preserving the chondrolabral junction reduces the rate of capsular adhesions

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ABSTRACT

The operative treatment of pincer-type femoroacetabular impingement (FAI) has become an increasingly more common procedure. Classically, the labrum is incised at the chondrolabral junction (CLJ), or a concurrent tear is extended to allow access to the acetabular rim facilitating acetabuloplasty. The labrum is subsequently repaired using suture anchors. More recently, acetabuloplasty has been performed without incising the labrum and negating the need to use suture anchors. The aim of this study is to determine whether preserving the CLJ reduces the incidence of revision hip arthroscopy for the treatment of capsulolabral adhesions. This retrospective study compared two cohorts of patients undergoing hip arthroscopy for pincer-type FAI from August 2002 to April 2015. The groups analysed were patients undergoing acetabuloplasty with labral repair (LR) and those with no labral repair (NLR). The revision rates and causes for revision were compared using the χ^2 analysis. There were 1010 cases in total. Acetabuloplasty with LR was performed in 546 hips (519 patients), while acetabuloplasty with NLR was performed in 464 hips (431 patients). In the LR group, there were 54 (9.9%) revisions, 25 (46%) of which were due to capsulolabral adhesions. The NLR group had 36 (7.8%) revisions with six (17%) due to capsulolabral adhesions. Preserving the CLJ, thereby avoiding the need for drilling and the insertion of suture anchors, when performing an acetabuloplasty for pincer-type FAI, significantly reduces the rate of symptomatic adhesions requiring revision arthroscopy.

INTRODUCTION

Femoroacetabular impingement (FAI) is caused by a repetitive and abnormal contact stress between the femoral head neck junction and the acetabular rim which can cause pain and may lead to early hip arthritis [1–3]. Pincer impingement occurs when an area of acetabular rim impinges on the femoral neck [1, 3]. A tear of the labrum is commonly seen at the site of impingement [4, 5]. This condition can be treated effectively with hip arthroscopy, which involves resection of the prominent bone on the acetabular rim and repair of the labral tear if present [6, 7]. However, the labrum is not always torn and the chondrolabral junction (CLJ) can be well preserved despite the presence of a prominent acetabular rim. In this circumstance, the question exists: can the pincer impingement be managed adequately without violating the intact CLJ?

The labrum functions to maintain hip stability and the synovial fluid seal around the joint [8–10]. It is therefore important to repair labral tears to preserve the fluid seal and maintain hip joint stability [9, 11, 12]. In addition, the importance of the CLJ and the unique complex junctional interface that exists in this region has been further elucidated [13]. Cashin *et al.* [14] studied this interface in further detail and identified that the 1–2-mm transition zone between the hyaline articular cartilage and the labrum identified as having different fibre alignment anteriorly and posteriorly. Therefore, it stands to reason that it would probably be best to try to preserve this unique attachment when possible. Gaining access to the acetabular rim is one of the key steps when addressing pincer impingement. In the presence of a labral tear further exposure to the rim can be achieved by extending the tear, but, in the vast

majority of cases the rim of the acetabulum is approached from the paralabral recess superiorly by partially releasing some of the superior capsule to gain adequate exposure. When the CLJ is torn, once the acetabular resection has been performed the labrum can be reattached with suture anchors. However, when the CLJ is intact, it is possible to avoid taking the labrum down by performing the acetabular ostectomy while working behind the CLJ [6]. The method avoids the use of sutures to reattach the labrum, which have been show to give rise to an inflammatory response which can lead to scarring [15].

Therefore, the aim of this study was to explore the revision rates of patients undergoing acetabular ostectomy with and without labral repair (LR). The authors hypothesized that pincer resection surgery performed without labral take down and repair would be associated with a lower incidence of revision surgery secondary to capsulolabral adhesions.

MATERIALS AND METHODS

This retrospective cohort study was conducted using the Hip Arthroscopy Australia database. Data are collected contemporaneously and reviewed for the purpose of quality assurance; ethical approval is therefore not required [16].

The database was searched from 1 August 2002 to 1 April 2015 for all cases in which an acetabular ostectomy had been performed. The data were further subcategorized into those patients who had undergone a LR and those who had not. No patients were excluded.

The two groups were compared. Revision rate, the time to revision from the index procedure and the intraoperative findings at revision surgery were analysed. The indications for revision surgery were persistent and/or recurrent groin pain, present for at least 3 months, and not responsive to conservative treatment, including a single intra-articular local anaesthetic and steroid injection. Plain radiographs and a magnetic resonance imaging scan of the affected hip were obtained for all patients.

The primary outcome measure was all-cause revision rate. Secondary outcome measures included presence of capsulolabral adhesions and time to revision surgery. Statistical analysis was performed using the χ^2 and the Student's *t*-tests where appropriate using Microsoft Excel (version 16.12) with a *P*-values of 0.05 considered significant.

Surgical technique

All hip arthroscopies were performed in the lateral decubitus position as described by the senior author [17].

When the CLJ was determined to be intact the bony rim was approached from the paralabral recess, using a radiofrequency device (ArthoWand, ArthroCare, Austin, TX, USA) to dissect soft tissue from the bone, and then the labrum was elevated from the bony edge using a combination of radiofrequency and sharp dissection. The pincer resection was then performed using a 5.5 mm burr. Care was taken to avoid damage to the intact CLJ. After bone resection, the CLJ was inspected. If it had remained intact, then no repair was required. If there was any chondrolabral defect identified; a repair using anchors was performed. A repair with suture anchors was also performed if there was delamination of the chondral surface with an intact CLJ.

In cases in which the labrum was torn the tear was minimally debrided where appropriate, and the labrum was reflected to allow access to the acetabular rim. In all cases performed before 2012, the CLJ was incised and labrum reflected. The area of bone required for resection was exposed and removed using a burr. The labrum was subsequently repaired. Repair was performed using suture anchors. (Bioraptor or Osteoraptor, Smith and Nephew, Andover, MA, USA), spaced approximately one centimetre apart. These anchors utilize a braided non-absorbable suture. Knots were tied externally, passed down to the labrum via an arthroscopic cannula (Smith and Nephew, Andover, MA, USA) and tensioned to avoid everting the labrum. The suture was cut with care taken to site the knots away from the articular cartilage and minimize redundant suture material.

RESULTS

A total of 1010 hips were operated on for pincer-type FAI between March 2003 and April 2015. Sixty patients had both hips operated on. No patients underwent bilateral hip arthroscopies on the same day. Demographics are comparable between both groups with no significant difference for side or sex. There is a significant difference in age between the groups (Table I).

In the LR group, 27% did not have a labral tear present at initial arthroscopic inspection, and therefore, the labrum was incised and taken down to perform the acetabuloplasty. Seventy-three percent had a labral tear which was used to gain access to the acetabular rim.

In the LR group, there were 54 (9.9%) revision arthroscopies performed. Forty-eight of those were revised by the senior author. Six patients underwent revision surgery by another surgeon and the indications and findings of these revisions are not known.

In the no labral repair (NLR) group, 36 (7.8%) revisions were performed. Thirty-three of those were revised

Table I. Demographics

	Labral repair	*No labral repair*	*P-value*
n	546 (519 patients)	464 (431 patients)	
Left:right	253:293	214:250	0.945
Mean age (years)	33 (14–70)	39 (15–72)	0.001
Male:female	322:224	269:195	0.748
Labral tear	147 (26.9%)	N/A	N/A
No labral tear	399 (73.1%)	N/A	N/A

by the senior author. Three patients underwent revision surgery by another surgeon and the indications and findings of these revisions are not known. There is no statistical difference between the LR and NLR groups regarding overall revision rate. There is a statistically significant difference in time to revision with a mean time of 20 months in the NLR group and 16 months in the LR group ($P = 0.026$).

Of the known revisions, the primary abnormality seen at arthroscopy in the LR group is capsulolabral adhesions in 46% ($n = 25$) of revisions. Whereas in the NLR group this accounts for 17% ($n = 6$) of revisions and is the fourth most common cause. The difference in revision rate for adhesions is statistically significant ($P = 0.002$). The incidence of symptomatic adhesions between groups is also significant ($P = 0.003$). There is also a statistically significant difference in revision rate due to cam lesions between the groups ($P = 0.002$). The incidence of symptomatic cam lesions is also significant ($P = 0.014$) (Table II).

DISCUSSION

The main finding of this study was that, by preserving the CLJ when performing an acetabuloplasty for pincer-type FAI, there was a significant reduction in the proportion of revisions due to capsulolabral adhesions from 46% to 17% (LR $n = 25$, NLR $n = 6$, $P = 0.002$). The overall revision rate was also lower in the NLR group although this difference did not reach statistical significance [LR 54 (9.9%) versus NLR 36 (7.8%) $P = 0.236$].

In 2014, Redmond *et al.* published a similar series of 190 hips in 174 patients. In 85 hips, the CLJ was in satisfactory condition on arthroscopic inspection and was left intact, while the acetabular rim resection was performed. In the remaining 105 hips, the CLJ was disrupted or the rim resection was technically not possible, the labral tear was extended and reflected to expose the rim. The labrum was then repaired using suture anchors. The authors reported no significant difference in post-operative patient reported outcome measures, pain scores or revision rates [6]. Comba *et al.* [7] reported similar findings in a smaller, mainly male cohort.

One of the concerns with detaching the labrum is that it may compromise the blood supply [6, 18, 19]. Kalhor *et al.* [20] performed a cadaveric study which demonstrated that the labrum receives its blood supply from the capsule. Philippon *et al.* [21] in their ovine model identified that incomplete healing of the labrum occurred when insufficient labrum fixation was performed.

Redmond *et al.* [6] noted that the group that required LR had a statistically significant greater anterior centre-edge angle (33.8° versus 29.5°). This suggests a deeper acetabulum which required more bone to be resected from the rim. There was no difference in rate of subsequent labral tears secondary to under-resection or interrupted blood supply in either group [6]. Conversely, over-resection leading to iatrogenic hip instability has also been reported [22]. In this study, there was one re-tear in the LR group with none reported in the NLR group. There were also no cases of over-resection although formal angle measures were not made routinely post-operatively.

It has been hypothesized that suture material may contribute to the development of post-operative capsulolabral adhesion [15, 23]. Capsulolabral adhesions are often seen in revision hip arthroscopy. These can be asymptomatic but can also cause pain and restriction of hip joint motion [24]. Kelly *et al.* [18] reported a regional difference with increased vascularity in the capsular side of the hip labrum and the adjacent capsulolabral recess. This can lead to the development of scar tissue during labral surgery. The presence of suture material has been shown to cause an inflammatory response in rabbit models, and therefore, may contribute to the formation of scar tissue [15, 23].

Table II. Revisions

	Labral repair	*No labral repair*	*P-value*
Overall revision rate	54 (9.9%)	36 (7.8%)	0.236
Revision by another surgeon	6	3	N/A
Revision by same surgeon	48	33	N/A
Adhesions	25 (46%)	6 (17%)	0.002
Non-specific synovitis	17 (35%)	19 (58%)	0.048
Partial ligamentum teres tear	12 (25%)	10 (30%)	0.598
Cam lesions	3 (4%)	11 (33%)	0.002
Synovitis	1 (2%)	0	N/A
Chondral calcification	1 (2%)	0	N/A
Labral tear	1 (2%)	0	N/A
Chondral flap	1 (2%)	0	N/A
Adductor tendon release	1 (2%)	0	N/A
Trochanteric bursectomy	1 (2%)	1 (3%)	N/A
Osteoarthritis	0	3 (9%)	N/A
No abnormality detected	0	2 (6%)	N/A
Time to revision (months)	16	20	0.026

The senior author has adapted his technique according to the aforementioned evidence. Since 2012, pincer-type impingement has been treated with arthroscopic acetabuloplasty without detaching the labrum if the CLJ was intact. In addition to the aforementioned benefits of avoiding suture anchors, keeping the labrum intact preserves the transitional zone between the chondral surface and the labrum which means that its function is not disturbed. Post-operative rehabilitation has also included early hip movement and circumduction to reduce the risk of adhesions forming [25].

The authors hypothesized that the presence of suture and/or anchor material may lead to increased inflammation. The process of drilling into the subchondral bone to place anchors stimulates bleeding and releases marrow cells. These factors may lead to adhesion formation. The data analysed for this study supports this hypothesis. In the absence of anchors, sutures and drill holes, the incidence of capsulolabral scaring was significantly lower compared with case where the labrum was repaired ($P = 0.002$).

Other recognized causes for revision hip arthroscopy are residual bony impingement and persistent labral pathology [26–28]. The increased proportion of revisions due to presence of CAM impingement in the NLR group (33%, $n = 11$) is statistically significant compared with the LR group (4%, $n = 3$) ($P = 0.002$). If the overall incidence is considered, the significance reduces [LR 0.5%, NLR 2.4% ($P = 0.014$)]. The authors suggest that this may be due to the apparent insignificance of a small CAM in the presence of minimal labral damage. As CAM resection carries additional risks and therefore needs to be considered in these cases [29].

Limitations to this study are around study design. All operations were performed by one surgeon, and these results may, therefore, not be generalizable. As with all retrospective reviews, there is a risk of selection bias and the possibilities of inaccuracies of the database. The intraoperative findings are at risk of observer bias as they are all reported by the surgeon and senior author. Early and late cases may be exposed to subtle differences as the technique evolved as mentioned above. The LR group may be

exposed to greater degenerative changes and therefore has an associated increase rate of post-operative symptoms. This, however, would not contribute to the higher rate of adhesions seen.

Pre- and post-operative centre-edge angle measurements were not formally recorded in each case. The large sample size contributes to counteracting some of these limitations.

CONCLUSION

If one is able to leave the CLJ intact when performing an acetabuloplasty for pincer-type FAI, the rate of symptomatic adhesions requiring revision arthroscopy is significantly reduced. The authors believe that is therefore preferred to preserve CLJ during acetabuloplasty with the aim to improve patients' symptoms, restore normal function and potentially prolong the longevity of the native hip joint.

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CONFLICT OF INTEREST STATEMENT

None declared.

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