

Evidence scan: Prevalence of labral tears in asymptomatic populations

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Author	Amanda Bowens, ACC Research
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1 Purpose & background

1.1 Background

ACC's Clinical Advisory Panel (CAP) has received a position statement from a group of surgeons who carry out hip arthroscopies. The surgeons are concerned that ACC declines a high proportion of requests for surgical repair of labral tears.

CAP therefore proposes to work with the surgeons to develop a consensus on when a labral tear is likely to be attributable to an injury. To support and inform these discussions, CAP has asked the Research team to produce an independent scan of the evidence on the prevalence of labral tears in different subgroups of people.

1.2 Purpose

This evidence scan provides a brief outline of research on the prevalence of labral tears in asymptomatic people. It is a first step to support consensus-building discussions on the clinical characteristics that might differentiate between a traumatic labral tear and one with gradual onset. It should be seen as a work in progress; further work may be required as discussions progress.

2 Methods

2.1 Identifying the evidence

To identify published research on the prevalence of labral tears, the following databases and information sources were searched on 11 July 2017:

- Embase on the Ovid platform
- Medline & Medline In-Process on the Ovid platform
- AMED on the Ovid platform
- Trip database at <https://www.tripdatabase.com/>
- UpToDate database

A broad exploratory search strategy focusing on the prevalence of labral injuries in all populations and subgroups was used. At this stage no limits were imposed on research methodology or study design. The search strategy is shown in the Appendix. Studies were also been sourced from colleagues in CAP and the Research team.

2.2 Selecting the studies

To be included in this evidence scan, identified research studies had to meet the following selection criteria:

- ⇒ Must be published in English, 2007 - present
- ⇒ Must report on the prevalence of labral tears in a defined asymptomatic population or subgroup (i.e. the general population or sportspeople)

Studies which appeared, from their titles and abstracts, to meet the selection criteria were retrieved in full and their content checked for a final decision on inclusion. Conference presentations and abstracts were included if they contain sufficiently detailed information on prevalence and population.

3 Findings

The search identified around 70 studies. Fifteen of these met the selection criteria for inclusion in the evidence scan. The studies were divided into two categories according to population: *asymptomatic people in the general population* and *asymptomatic physically active people including sportspeople*. Key details and findings are summarised in the following tables. Note: the column on labral pathology prevalence and the row on the single identified New Zealand study are shaded for emphasis.

3.1 Asymptomatic people in the general population

Six studies focus on asymptomatic people in the general population. Two are systematic reviews and four are primary studies. The primary studies use cross sectional designs and investigate populations in the United States (one study) and Switzerland (three studies).

Study & country of origin	Population(s)	Participants: numbers & characteristics	Prevalence of labral pathology	Other findings, e.g. prevalence of cam	Study conclusions
Secondary research					
Frank et al 2015 ¹ Systematic review International scope Also included in table below, see section 3.2 <i>Asymptomatic, physically active people including sportspeople</i>	Prevalence studies of femoroacetabular impingement (FAI) in asymptomatic volunteers	26 studies were included: ⇒ 1,057 participants (57.2% male, 42.8% female), 2,114 hips ⇒ Mean participant age was 25.3 ±1.5 years 33% of participants (669 hips) were athletes or physically active people (collegiate US football, army recruits, ice hockey)	Labral injury was found on MRI in 68.1% of the general population The prevalence in athletes was 65.4% Note: only 7 of the 26 studies reported on labral injury	Cam: overall prevalence was 37% Prevalence in the general population was 23.1% Prevalence in athletes was 54.8%	FAI and labral injuries are common in asymptomatic people Athletes made up a high proportion of the sample: possible selection bias? Cam is significantly more prevalent in athletes Level of evidence IV: systematic review of level II-IV studies
Kwee et al 2013 ² Systematic review International scope	Studies of normal anatomical variants of the labrum detected on MRI	35 studies were included, ages were not reported 8 studies involved asymptomatic subjects: ⇒ These studies included 548 subjects (1,096 hips) ⇒ The quality scores of these studies ranged from 40% to 80% with a median of 70%	In the 8 studies of asymptomatic subjects: ⇒ Labral tears were reported in 213 hips A prevalence of 19% of all hips in asymptomatic studies was quoted; however, as only 3 of the 8 studies reported on labral tears, prevalence may be underestimated	In the asymptomatic subject studies: ⇒ One included study showed an association between labral lesions and cam morphology, see Reichenbach et al ³ below	The most common shape of the normal hip labrum is triangular Rounded, flattened and teardrop shapes are less frequent, but are also seen in asymptomatic people; they could however represent the effects of previous labral degeneration

Primary studies in population age order, youngest to oldest					
Leunig et al 2013 ⁴ Cross sectional, population based study Switzerland; companion study to Reichenbach et al ³ below	Females attending Swiss vocational schools	283 consecutive females agreed to participate, 136 were invited to undergo MRI and 80 actually attended The mean age was 19.3 years	Labral lesions were found in 17 participants (adjusted prevalence 19%)	15 participants showed some evidence of cam (adjusted prevalence 22%); none met specified criteria for definite cam & there was no association with hip joint damage The prevalence of increased acetabular depth was 10%, but there was no association with labral damage	Definite cam is rare in women compared to the 24% prevalence seen in men ³ This suggests FAI may have different, gender- related bio-mechanisms
Reichenbach et al 2011 ³ Cross sectional, population based study Switzerland	Male Swiss army conscripts attending mandatory recruitment sessions	Of 1,080 eligible subjects, 430 were invited to undergo MRI and 244 actually attended The mean age was 19.9 years	Labral lesions were detected in 78% of participants overall Association with cam: ⇒ 57 (85%) of the 67 participants with cam deformity ⇒ 118 (67%) of 177 participants without cam The adjusted odds ratio was 2.77 (95% CI 1.31, 5.87) (adjusted for age & BMI)	67 participants (adjusted prevalence 24%) showed definite cam type deformities Those with cam were significantly heavier Labral lesions were significantly more common in participants with cam	Cam morphology is associated with MRI- detected hip damage in asymptomatic young men
Tresch et al 2016 ⁵ Cross sectional study Switzerland	Asymptomatic volunteers Symptomatic patients with FAI	63 patients with FAI 63 age- and sex-matched asymptomatic volunteers Mean age 34.9 (range 20- 50) years	Defects of the labrum or articular cartilage were seen in 57% of volunteers vs. 80% of symptomatic patients Labrum and cartilage defects were more common in male volunteers than female volunteers Labrum tears: seen in 44% of volunteers vs. 61% of patients	Acetabular cartilage defects: seen in 14% of volunteers vs. 47% of patients Femoral cartilage defects: seen in 6% of volunteers vs. 30% of patients	Not all defects were symptomatic A substantial number of asymptomatic subjects had labral tears and cartilage defects Location of defects was similar in asymptomatic and symptomatic subjects Level of evidence II

Register et al 2012 ⁶ Cross sectional study United States	Asymptomatic volunteers Recruited from the community in a rural US county	45 people, mean age 37.8 (range 15-66) years, 27 (60%) male	Labral tears were identified in 69% of hips & were the most frequently identified hip lesions ⇒ Tears were associated with age, cam, chondral defects and other fibrocystic & bony abnormalities Mean alpha angle was higher in those with labral tears (63° vs. 58°)	Abnormalities (including labral tears) were identified in 73% of hips The presence of chondral defects, subchondral cysts and cartilage degeneration was correlated with age The mean alpha angle of the whole cohort was 60.7° (range 45°-74°)	A surprisingly high rate of labral abnormalities was found in a relatively young population (60% were under 40) Level of evidence III
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3.2 Asymptomatic physically active people including sportspeople

Ten studies focus on asymptomatic, physically active people including sportspeople. One is a systematic review and nine are primary studies. The primary studies are described by their authors as using cross sectional, cohort, case control or case series designs. Two of the primary studies are currently only available as abstracts. Five studies were United States based; the others included one each from the United Kingdom, Germany, Australia and New Zealand. The New Zealand study⁷ is of particular interest, as the authors intend to follow their cohort (medical students and allied health professionals at Christchurch Hospital) further.

Populations included in these studies participated in the following activities (n=number of studies): ice hockey (n=5); skiing (n=2); mixed activities (n=2); ballet (n=1); American football (n=1); golf (n=1); and track and field athletics (n=1). Participation was at all levels from amateur to elite professional. In addition, two of the included studies investigated physically active military populations^{1 18}. Two studies were excluded because they focused on mixed symptomatic/asymptomatic populations: Farrell et al 2016⁸ (rugby union, Ireland) and Kolo et al 2013⁹ (ballet, Switzerland).

Study & country of origin	Population(s)	Participants: numbers & characteristics	Prevalence of labral pathology	Other findings, e.g. prevalence of cam	Study conclusions
Secondary research					
Frank et al 2015 ¹ Systematic review International scope Also included in table above	Prevalence studies of femoroacetabular impingement (FAI) in asymptomatic volunteers	26 studies were included: ⇒ 1,057 participants (57.2% male, 42.8% female), 2,114 hips ⇒ Mean participant age was 25.3 ±1.5 years 33% of participants (669 hips) were athletes or	The prevalence of labral injury in athletes was 65.4% vs. 68.1% in the general population Note: only 7 of the 26 studies reported on labral injury	Cam: overall prevalence was 37% Prevalence in athletes was 54.8% Prevalence in the general population was 23.1%	FAI and labral injuries are common in asymptomatic people Cam is significantly more prevalent in athletes Level of evidence IV: systematic review of level

physically active people (collegiate US football, army recruits, ice hockey)			II-IV studies		
Primary studies in population age order, youngest to oldest					
Philippon et al 2013 ¹⁰ Cohort study United States	Youth ice hockey players Youth skier controls Recruited as participants in a hip screening programme	Ice hockey: 61 players aged 10-18 (mean 14.5) years Skiers: 27 skiers aged 10- 18 (mean 15.2) years Participants were all male	High percentages of labral tears were observed in both groups In the 16-19 age group 93% of hockey players had labral tears vs. 75% of skiers (possible age correlation?)	Ice hockey players had significantly higher alpha angles: ⇒ 75% had alpha angles ≥55° vs. 42% of skiers ⇒ Hockey players were 4.46 times more likely to have an alpha angle ≥55° There was a correlation between increased age & increased alpha angle in the hockey players, but not in the skiers	A higher prevalence of increased alpha angles, associated with cam morphology, was seen in ice hockey players vs. age-matched skiers By age 16-19, 93% of the hockey group had developed labral tears Playing ice hockey may increase the risk of high alpha angles Level of evidence III
Philippon et al 2014 ¹¹ Longitudinal study (conference abstract) United States	Youth ice hockey players Recruited from pre- participation screening	15 players aged 10-16 years All played an average of 42 weeks per year over the 3 years of the study	By year 3, 12/15 (80%) had asymptomatic labral tears	Players had significantly increased alpha angles by year 3: ⇒ Mean 56° (range 45°- 63°) at year 1 ⇒ 59° (52°-68°) at year 2 ⇒ 75° (64°-88°) at year 3	Young ice hockey players show increasing alpha angles and development of asymptomatic labral tears over 3 years of play
Briggs et al 2017 ¹² Abstract only United States	Asymptomatic young sportspeople Recruited via a screening programme	101 young (i.e. ≤19 years of age) sportspeople: ⇒ 20 skiers and 81 ice hockey players ⇒ 93 males, 8 females ⇒ Average age 15 (range 11-19)	Labral tears were identified in 70 hips: ⇒ 89% of participants aged 16 or over had labral tears ⇒ 56% of participants aged 16 or younger had labral tears Participants aged ≥16 were 7 times more likely to have a tear than those aged <16 Those who had participated in their sport	Average alpha angle was 59°	This study showed a high prevalence of labral tears in asymptomatic young athletes Athletes who were older and had participated in their sport for longer had an increased risk of a labral tear Limiting certain “at risk” movements when the young athlete is growing may have potential for preventing labral tears

			for ≥ 9 years were 4.9 times more likely to have a tear		
Lahner et al 2014 ¹³ Controlled cross sectional study Germany	Elite track and field athletes Non-athlete controls The controls were volunteers from a German university	22 athletes, 11 male, 11 female, mean age 23.7 \pm 3 years 22 non-athletes, 11 male, 11 female, mean age 22.4 \pm 4.2 years	2 (9%) of the athletes had a labral tear vs. 1 (4.5%) of the controls	11 (50%) of the athletes had cam impingement vs. 1 (4.5%) of the controls (the control was female and had mixed cam/pincer morphology) The mean value alpha angle was significantly higher in the athlete group (52.2 \pm 7.3° vs. 48 \pm 5.45°)	Cam is more common in elite athletes compared to non-athletes Intense practice of track and field athletics is associated with susceptibility to FAI
Silvis et al 2011 ¹⁴ Cross sectional study United States	Collegiate and professional ice hockey players Recruited from active player rosters of 2 US ice hockey clubs	N=39; 21 professional and 18 collegiate ice hockey players, all male Ages not reported (approx. 24-25 years?)	Labral tears were reported in 22 (56%) of 39 participants: ⇒ Of these 22 participants, 16 (72%) had cam morphology	Alpha angle >55° (indicative of cam morphology) was reported in 15 (39%) of 39 participants: ⇒ Of these 15 participants, 12 (80%) had an associated labral tear	A high prevalence of MRI-detected abnormalities was observed in asymptomatic ice hockey players Level of evidence III ⇒ A follow up study ¹⁵ of the professional players found that most remained asymptomatic at 2 years (level of evidence IV)
Lee et al 2015 ⁷ Cross sectional study Note: New Zealand study The authors intend to follow this cohort	Asymptomatic volunteers Recruited from medical students and allied health professionals at Christchurch Hospital	70 young adults, mean age 26 (range 19-41) years: ⇒ 47 female, 23 male ⇒ Subjects were physically active: 70% were regular or occasional participants in "impact sports", e.g. rugby, football, hockey, martial arts, running, ballet	Labral tears were found in 27 participants (38.6%): ⇒ Tears were an isolated finding in 16 (22.9%) and associated with other intra-articular pathology in the remaining 11 (15.7%) ⇒ The median age of those with a tear was slightly higher than those without (26.6 vs. 24.7 years) ⇒ There were no	32 participants (45.7%) had other intra-articular pathology (e.g. cysts, chondral damage): ⇒ There was a strong association between intra-articular pathology and tears compared to those without intra-articular pathology (90.9% v. 28.8%) There was a trend towards higher mean alpha angles in those with	Given the high prevalence of labral pathology in asymptomatic people, it is important to confirm that a patient's symptoms are due to the demonstrated abnormalities when considering surgery The decision to treat should not be based on the presence of an MRI-detected labral tear alone

			significant associations between presence of a tear and sex, ethnicity, BMI or activity level	a tear: ⇒ 57.8°, 95% CI 54.4° to 61.1° versus 54.0°, 95% CI 51.6° to 56.4°; p = 0.058	
Dickenson et al 2016 ¹⁶ Cross sectional study United Kingdom	Elite golfers Recruited at tournament in Scotland	55 male golfers (52 left hip lead, typical in right handed golfers) Mean age 28 (±5.5) years	Labral tears were detected in 37% of trail hips and 16% of lead hips	9/52 (16%) of participants had cam morphology (7 in trail hip and 2 in both hips)	Golfers' trail and lead hips have different morphology
Mayes et al 2016 ¹⁷ Case control study Australia	Professional ballet dancers Age- and sex-matched sports participant controls	Ballet: 49 professional ballet dancers: ⇒ 33 current, 16 retired but still teaching ⇒ 21 male, 28 female ⇒ Mean age 30 (range 19-64) years Sports: 49 age- and sex-matched controls: ⇒ playing tennis, netball or basketball at least 2-3 times per week since childhood	Labral tears were prevalent in both groups 60 (61%) participants had a tear in at least one hip; overall there were tears in 51% of all 196 hips Prevalence did not differ significantly between activity groups or sexes Participants with labral tears were significantly older than those without	Pain symptoms were observed in both dancers and sportspeople with no significant differences between groups ⇒ No relationship was found between pain and presence of a labral tear 44% of participants had cartilage defects ⇒ These were strongly associated with labral tears	The prevalence of tears in ballet dancers was similar to that in a matched sporting population Labral tears were not associated with clinical findings, but were strongly related to cartilage defects independent of ageing Labral tears may not be the cause of dancers' symptoms
Schmitz et al 2012 ¹⁸ Case series (prevalence) United States	Asymptomatic volunteers Active duty US Air Force personnel examined as part of their yearly fitness checks	16 male and 5 female participants (42 hips) Mean age 34 (range 27-43) years	Two radiologists identified labral tears in 85.7% and 80.9% of hips respectively	Two radiologists identified paralabral cysts in 26.2% and 21.4% of hips respectively	Labral tears can occur without symptoms Level of evidence IV

4 Discussion & conclusions

The key systematic review covering both general and athletic populations is the 2015 study on the prevalence of femoroacetabular impingement by Frank et al¹. It found the prevalence of asymptomatic labral injury to be high: 68.1% in the general population and 65.4% in athletes. However, only 7 of the 26 included studies reported specifically on labral injury. The review found that cam was significantly more prevalent in athletes at 54.8% versus 23.1% in the general population. The authors commented that *“the high prevalence of cam deformity in the athletic population raises the issue of whether cam deformity leads to labral injury or if labral injury is associated with cam deformity”*.

A small (n=45) cross sectional study of asymptomatic volunteers in a relatively young US population found a similarly high prevalence of labral tears (69%)⁶. This study also reported associations with cam and with age.

Two studies investigated the prevalence of hip deformities in Swiss cohorts of young men (n=244)³ and young women (n=80)⁴. In the men, an association was found between cam morphology (prevalence 24%) and labral lesions (prevalence 78%), with an odds ratio of 2.77. In women however, labral lesions were much less prevalent (19%) and cam was rare, suggesting no association and possibly different, gender-related bio-mechanisms of femoroacetabular impingement.

Notable findings from the primary studies on physically active people included:

- A high (56%-89%) prevalence of labral tears in young (≤ 19 years, n=101), mostly male skiers and hockey players¹²; prevalence increased with age and with years of sports participation.
- A strong association between intra-articular pathology (e.g. cysts, chondral damage) and labral tears, and a tendency towards higher alpha angles in those with tears, in a cohort (n=70) of young New Zealand medical students and health professionals⁷.
- A high (61%) prevalence of labral tears and a strong association between cartilage defects and tears in matched cohorts of professional ballet dancers and sportspeople (n=98)¹⁷
- High prevalences of labral tears in young ice hockey players and skiers (n=88); these were associated with cam morphology, age and increased time playing the sport in ice hockey players, but not in skiers¹⁰.
- Evidence that playing ice hockey increases the risk of cam morphology and labral tears over time^{10 11}.
- A high (80.9-85.7%) prevalence of labral tears in active duty US Air Force personnel (n=21)¹⁸.
- A strong association between labral tears and cam morphology in male hockey players¹⁴.

In summary,

- Studies show high prevalences of labral pathology in asymptomatic populations, particularly those that are physically active.
- Associations between labral tears and cam morphology, male gender, age, chondral/cartilage defects, type of sport and time playing sport are reported in some studies.

5 Limitations of the evidence scan

Due to time constraints, the means by which labral tears were diagnosed in these studies was not reported in the tables. However, MRI at either 1.5T or 3T appeared to be the norm. It may also have been useful to investigate the variable terminology used across the studies (labral tears, labral injury, labral lesions etc.) and establish whether and to what extent different pathologies were being described.

Please note that this evidence scan represents a work in progress. CAP has asked us to focus on the prevalence of labral tears in the asymptomatic general population and asymptomatic, physically active people; hence this is our starting point. Information on other populations and subgroups may be added as the work evolves.

The intention of this evidence scan is to provide an overview of what the literature can offer in evaluating the aetiology of labral tears. The scan is not a full review of the literature and studies have not been critically appraised for methodological quality.

6 References

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7 Appendix

7.1 Search strategy

The following search strategy was developed in the Medline database and adapted for use in the other databases:

1. ((labral or labrum) adj3 (tear\$ or lesion\$ or injur\$)).mp.
 2. prevalen\$.mp.
 3. 1 and 2
 4. limit 3 to english language
 5. limit 4 to yr="2007 - Current"
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