7 - ACETABULAR LABRAL TEARS AND PHYSICAL THERAPY - A LITERATURE REVIEW

BRUNO SEARA POLIDORO; ANDRÉ LUIZ ALMEIDA PIZZOLATTI; FABIO SPRADA DE MENEZES
Projeto de Extensão em Fisioterapia Desportiva
Universidade do Estado de Santa Catarina UDESC, Florianópolis, SC, Brasil.
d3fsm@udesc.br

Introduction

The intra-articular injuries of the hip are very incapacitating for the patient and generally cause many difficulties of treatment. The acetabular labral tears are a potential cause of hip pain and incapacitation, becoming common in the physical therapy practice. Furthermore, several researches showed an increase of surgical treatment and few authors first recommends a conservator conduct in the labral tear. The aim of this review is to study these injuries and to propose rehabilitation programs for acetabular labral tears.

Anatomy

The hip is a triaxial, synovial and ball and socket joint, between the head of the femur and the acetabulum of the iliac bone. The hip joint is reinforced by a fibrous articular capsula. The acetabular labrum is a fibrocartilaginous rim, which encompasses the circunference of the acetabulum. In the cross-section, the acetabular labrum is generally triangular which in the antero-inferior section is thinner and usually thicker and slightly rounded posteriorly (MASON *et al*, 2001). It has three surfaces: an internal articular surface, an external surface contacting the joint capsule, and a basal surface attached to the acetabular bone and transverse ligaments (NARVANI *et al,* 2002).

Histologicaly, the labrum is composed for Type I Collagen fiber bundles principally arranged parallel to the acetabular rim, with some fibers running obliquely (NARVANI *et al,* 2002). Several research has been confirmed the microvascular anatomy of the acetabular labrum. An imunohistochemical study of McCarthy *et al* (2003), with 10 cadaveric acetabular labra, showed that the vascular supply comes by obturatory artery, and the superior and inferior gluteal artery. These vessels supply the acetabular structure and synovial tissue in the labrum capsular sulcus. They concluded there was no evidence of the penetration of vessels into the labral substance as well as any regions of relative hypovascularity. Furthermore, Mason *et al* (2001) affirms that, in the exception of 0,5mm in the outermost layer on the capsular surface, the acetabular labrum is relatively hypovascular. Kelly *et al* (2005) demonstrated there were relative differences between zones in the acetabular labrum. It was observed more vascularity in the portion of the zone attached to the bony acetabulum than articular zone (no attached to the bony acetabulum). However, vascularity patterns didn't demonstrated significantly differences in the anterior, posterior, superior, and inferior labral regions.

Kim and Azuma (1995), and Suenaga *et al apud* Mchiro *et al* (2004) found sensory nerve endings, Pacini, Ruffini, Golgi, and Krause (articular) corpuscles especially in the superficial zone in the acetabular labrum. The authors confirm free nerve endings concentrated about the superior and anterior quarters of the labrum. They suggested that the labrum has pain signalling and proprioceptive properties.

Labral biomechanics

As already demonstrated, the labrum is a fibrocartilagenous structure composed of radially orientated collagen fibers attached to the osseous rim of the acetabulum. A possible role of this peripheral structure is to seal the joint, thereby providing stability by allowing atmospheric pressure to aid in keeping the joint reduced. (McCARTHY *et al*, 2003; SCHMERL *et al*, 2005).

Thereupon, the acetabular labrum does increase the articular surface area of the hip joint. It is also likely that the labrum increases hip joint stability while decreasing contact pressures between the articular surfaces of the acetabulum and femoral head reducing contact stress, or force per unit area. In addition to the stability, the labrum contributes 22% to 28% to the articular surface area of the hip and increases the acetabular volume by 33%. (LEWIS & SAHRMANN, 2006; HUFFMAN & SAFRAN, 2002; TAN *et al, apud* SCHMERL *et al*, 2005).

Evidences suggest that the intact labrum may enhance stability by providing a negative intra-articular pressure within the hip joint. (HUFFMAN & SAFRAN, 2002; SCHMERL *et al*, 2005). Lewis & Sahrman (2006) ascertained that the labrum plays an important role in the ability of the cartilage layers to carry and distribute loads by fluid pressurization, possibly by providing a sealing function for the joint. A tear in the labrum may compromise this seal, thus leading to higher stresses, poorly handled loads, and possibly joint deterioration. (LEWIS & SAHRMANN, 2006).

Another possible function of the labrum as Tan *et al, apud* Schmerl *et al* (2005), have shown, is to weight bearing and don't provides congruence only. In their studies, they attempted to find how much of de articular contact surface percentage area (28% for them), has really a weight-bearing role. They has been suggested that the labrum may become a weight-bearing structure in the extremes of hip range of motion (ROM), because it was also found that the labrum deepened the socket by an average of 5 mm.

However, there are a big amount of divergences among several authors about the real weight-bearing values after labral remove. Binningsley (2003) and Ferguson (2003), found increase values about 92% for pressure and frictional force between de acetabulum and de femoral head, after labrum removal, however, contradicting this authors, Konrath *et al*(1998), concluded that removal of the labrum does not significantly increase the pressure between the acetabulum and femoral head and may not predispose to osteoarthritis.

Etiology

McCarthy *et al* (2003) has related that the contribution of the labrum to joint stability may be expected to be greatest at the extremes of motion where impingement can cause traumatic dislocation. It has been suggested that the acetabular labrum might play a role in the development of hip osteoarthritis.

Wenger *et al* (2004) had concluded that the majority of patients in this population with labral tears have a structural hip abnormality detectable (some subtle) with conventional radiographs. Overall, 87% of patients with labral tears had at least one underlying structural abnormality.

Labral tears are common in patients with degenerative hip disease or acetabular dysplasia, associated to an insufficient femoral head coverage, acetabular retroversion and/or femoral external rotation. (McCARTHY *et al*, 2003; NICHOLLS, 2004; LEUNIG *et al*, 2004;).

Hyperlordosis of the lumbar spine and Hip flexion contracture might lead to increased weight-bearing upon the

anterior acetabulum and labrum predisposing to tearing. It is explained by a greater functional acetabular retroversion resulting the anterior pelvis rotation, possibly increasing the risk of an impingement of the anterosuperior acetabular rim during functional activities. (SCHMERL *et al*, 2005, REYNOLDS *et al*., 1999 *apud* NICHOLLS, 2004;)

The degenerative hip diseases could be two types, being them developmental dysplasia of the hip (DDH) and femoroacetabular impingement (FAI). The first one occurs due an anterolateral migration of the femoral head, which induces chronic shear stresses at the acetabular rim. The enlarged acetabular labrum initially aids in maintaining the femoral head within the joint. If the chronic shear stress persists, the labral soft tissue compensation fails, tearing the labrum off the acetabular rim, sometimes with a bony fragment. It is result of deficient acetabular coverage of the femoral head, leading instability and oastheortrosis. The second ones arises for during flexion of the hip. Repetitive peak contact pressures occurs when the prominent femoral head-neck junction abuts against the acetabular rim or enters the joint due to excessive acetabular coverage and/or an insufficient femoral head-neck offset reduces the joint clearance causing impingement, which also has been related to osteoarthritis. Abnormal morphologic features of the proximal femur, abnormal orientation and shape of the acetabulum also contribute to this disorder (LEUNIG *et al*, 2004).

About the location, tears can be anterior, posterior, or superior (lateral). The sites of labral pathology correspond to the maximal sites of stress in the acetabulum resulting from the force vector from the femoral head maximally loading the acetabulum superiorly and anteromedially, being anteriorly the most common kind of Tears (BRUCE *et al*, 2004; McCARTHY *et al*, 2003)

Nicholls (2004) describes that certain athletic events can predispose the hip to repetitive extremes of motion. Sports such as golf, tennis, baseball, hockey, and american football involve frequent external rotation of the hip. Guanche *et al* 2005 also found labral tears in elite runners. Hyperextension combined with femoral external rotation is the injury pattern most commonly associated with an acute presentation of labral tearing. This injury mechanism is associated with anterior labral pathology.

Schmerl *et al* (2005), described in the North American population, tears are most frequently anterior and are often associated with sudden twisting or pivoting motions. In the Asian population, tears are more frequently posterior and associated with hyper flexion or squatting motions.

Labral tears secondary to a trauma generally are isolated to one particular region depending on the direction and extent of trauma. Patients with known posterior subluxation or dislocation most frequently have posterior labral tears, just like traffic victims accidents due the resulting of dashboard strike lesion, against the femoral axis. The magnitude of force will determine whether the tear is initiated on the articular or acetabular side of the joint (McCARTHY *et al*, 2003).

Clinical Features

The patient history determines the source of the patient's symptoms. The interviewer should determine relationship between symptoms, patient's activity, instability, overload, episodes trauma associated (Clohisy *et al* 2005), or "giving way" (Binningsley 2003). The patients with labral injury relate articular click and sharp higher pain by walking or sporting activities (McCarthy *et al* 2002). Hase *apud* Binningsley (2003) affirm that labrum tears correlates with anterior inguinal pain, anterior thigh and buttock around the greater trochanter. In clinical exam the patient normally presents flexion, internal rotation and abduction significantly limited (McCarthy *et al* 2002). The McCarthy's sign is a specific test for the acetabular labral tears. This test reproduce painful click with both hips full flexed, and extending first with external rotation and later with internal rotation. These two tests shock femur head with anterior and superior acetabular rim, which the labrum is commonly tear. Fitzgerald *et al apud* Anderson *et al* 2001 had proposed a test for to differentiate anterior and superior labral tears. The maneuver for the anterior injury is a hip flexion, external rotation and abduction followed by the extension, internal rotation and adduction. For the posterior labral tears a passive flexion, internal rotation and a posterior load. Binningsley (2003), Lewis & Sahrmann (2006) cited The Fabre test for the impingement of the femur head with acetabular rim. It is done with hip flexion, abduction with the small end range amplitude and external rotation. This test elicited pain in 88% of patients (15 of 17) with intra-articular pathology.

Currently, acetabular labral tears have been recognized because of the advance of image examination techniques. Frequently, the image examination is done when it has a clinic diagnosis with suspicion. Among the image techniques, Magnetic Resonance Arthrography (MRa) and Arthroscopy are considered the gold standard by many authors. Czerny *et al* 1996 showed evidences of labral tears in 56 hips into 57 patients. In 20 of them has been proved with surgical findings. These studies had confirmed a high accuracy and sensitivity of the RMa. However, Keeney *apud* Clohisy *et al* (2005) had demonstrated the limited sensitivity and affirm that false negative is not uncommon. Because of developments in the techniques and instrumentation, the hip arthroscopy has been increased in the last 10 years (Binningsley 2003). McCarthy *et al* (2001) examined 436 hip arthroscopies and found 261 labral tears, and 54 acetabula from cadavers had evidenced 52 labral injuries.

Treatment of labral tears

Physical Therapy in Conservative Treatment

The appropriate physical therapy treatment for a patient with acetabular labral tears has yet to be established, and we found few published articles on treating labral tears. But our experience with these patients had demonstrated some good results mainly in relief of pain and recovery to sports activities.

Dirocco *et al* (2003) had related many impairments associated with labral injuries; these include inflammation, pain, swelling, decreased joint mobility, "giving away" sensation, altered muscle extensibility, impaired muscle strength, altered proprioception, and decreased muscle endurance. Rehabilitation protocols should be designed to address these impairments.

The first step in a physical therapy treatment is to eliminate the pain. Ikeda *et al* (1988), had recommended a trial periods of non-or partial weight bearing for up to three months as a conservative management strategy. This has followed with reports of decreased pain in most patients (NICHOLLS, 2004). Every pivoting motion is avoided. To relief pain in groin, greater trochanter and anterior face of thigh, therapeutic modalities like cryotherapy, eletroanalgesic therapy, the Trigger Points Therapy and ultrasound can be used. The pain limits should be respected in the beggining of kinesiotherapy.

The second step is the stabilization of femur head in acetabular cavity. The abscence of labrum makes a laxity in the hip structure. Management of the instability may be addressed conservatively. Movement impairments of the lower limb kinetic chain may be considered when treating patients with pain of insidious onset. Altered recruitment of hip musculature may affect the femoral head path of instantaneous centre of rotation within the acetabulum (LEWIS & SAHRMANN, 2006).

Lewis and Sahrmann (2006) believes that an appropriate intervention should focus on reducing anteriorly directed forces on the hip by addressing the patterns of recruitment of muscles that control hip motion, by correcting the movement patterns during exercises such as hip extension and during gait, and by instruction in the avoidance of pivoting motions in which the acetabulum rotates on the femur, particularly under load. The general goal of the intervention is to optimize the alignment of the hip joint and the precision of joint motion, particularly avoiding excessive forces into the anterior hip joint.

Altered or exaggerated femoral head accessory movement may result when hip physiological motions are dominated

more by the global, two joint lower limb muscles such as hamstrings, rectus femoris, and tensor fascia lata (TFL) than the intrinsic, one joint hip muscles (LEWIS & SAHRMANN, 2006).

Commonly, the TFL, rectus femoris, and hamstring muscles are dominant and stiff where the posterior gluteus medius, gluteus maximus, and iliopsoas muscles are long or weak (LEWIS & SAHRMANN, 2006). Strategies aimed at reducing the relative stiffness of the TFL, rectus femoris, and hamstrings during hip motions while improving the strength and control of the gluteus medius, gluteus maximus, and iliopsoas muscles are beneficial. McCarthy *et al* (2003) also postulated that with an anterior tear, the labrum gives way slightly in extreme positions of hip external rotation, leading to sliding of the femur in contact with the labrum.

An over-dominance of the hip lateral rotators relative to the hip medial rotators may be evident in this presentation. Careful observation of active knee flexion in prone or straight leg raise in supine may display a trend of hip lateral rotation during such movements (LEWIS & SAHRMANN, 2006). There may also be a greater amount of hip lateral rotation than medial rotation. Therefore, treatment aimed toward decreasing the dominance of the lateral rotator muscles and increased participation of hip medial rotator muscles with hip flexion and extension may help to reduce symptoms and instability (Nicholls, 2004).

Faulty movement patterns should also be addressed while improving muscle strength and endurance. Griffin (2001) states that proprioceptive deficits routinely occur in conjunction with injury to the joint surfaces. This inhibits normal motor response and decreases neuromuscular stabilization of the joint. Thus, proprioceptive retraining is important to restore these deficits and assist in re-establishing neuromotor control. Altered gait and weight-bearing mechanics are likely to predispose to sacroiliac and lumbar spine dysfunction. The lumbopelvic rhythm must be assessed in all patients with altered hip mechanics. Spinal manipulative therapy is likely to be of use in those patients with sacroiliac joint and lumbar spine dysfunction. Abdominal core (transverses abdominus) stabilization exercises are also likely to be of use in restoring correct lumbopelvic biomechanics.

Exercises may include swimming using a pool buoy, deep water running. Other low impact exercise may also be beneficial such as Pilates, fitball, or yoga, to help maintain core strength and flexibility. Lewis and Sahrmann (2006) describes that cycling is a good activity. These exercises improve the cardiac and respiratory condition, provide motion to the hip and maintain endurance of the lower-extremity musculature. But, a recumbent bicycle should be avoided because of the excessive hip flexion and the tendency to use the hip flexor muscles to maintain the foot on the pedal.

After these steps, the progressive back-to-sports activities should be estimulated. Physical fitness conditioning and specific sports activities should be started. Schmerl *et al* (2005) recommends the introduction of proprioception and plyometric training with slow return to work or sporting activity. Patients with labral tears without evidence of articular cartilage involvement may progress more quickly to closed kinematic-chain, weight-bearing exercise and return more quickly to sports or to physically demanding jobs. Return to sport in surgery case is usually possible in 2 to 4 months.

Surgery and Post-Operative Rehabilitation

Operative intervention is warranted for patients who not respond to nonoperative management and for athletes who have already missed significant participation secondary to delayed diagnosis. Is very important to observe that labral tears do not seem to heal naturally. (IKEDA, 1988; HUFFMAN & SAFRAN, 2002).

Presently, arthroscopic debridement of labral tears is the operative treatment of choice. The arthroscopic labrectomy provide re-establish and relief the symptoms. However, if the results of short-term follow-up are positive, the long-term results are still unknown, due to the mechanical properties structure alteration. (MURPHY *et al*, 2006; SCHMERL *et al*, 2005).

The results after arthrotomy and partial labral resection for labral tears have been favorable. In a study of Fitzgerald (1995) *apud* Huffman & Safran (2002), it was reported that 89% overall favorable results at long date. Huffman & Safran (2002) had related complications, such as trochanteric bursitis, increased blood loss, and the potential for osteonecrosis.

Arthrotomy has limitations when used to treat labral tears. Therefore, although arthroscopic treatment is preferable, the surgeon should be prepared to treat symptomatic labral tears through an arthrotomy when necessary.

In postoperative rehabilitation cases, through hip arthroscopic approaches, the procedures are similar. The differences are about to protect the joint and limit ROM and continuous passive motion (CPM) devices. The protection joint and limit ROM, particularly hip abduction and rotation it's made through a brace. The brace is worn during ambulation for approximately 10 postoperative days and it's set at a neutral position to approximately 80° of flexion in the sagittal plane. A continuous passive motion (CPM) device is prescribed to be used for up to 8 hours per day for 2 to 4 weeks in all patients undergoing hip arthroscopy to reduce the risk of developing postoperative adhesions and to encourage early postoperative healing. The initial setting provides movement between 30° and 70° of flexion. This can be increased as tolerated, with an eventual goal of movement between full extension and maximally tolerated flexion. Full passive ROM, as dictated by patient tolerance, is typically allowed at 14 days after surgery (ENSEKI *et al*, 2006).

REFERENCES:

BINNINGSLEY D. Tear of the acetabular labrum in an elite athlete. *British Journal of Sports Medicine*. v. 37, p. 84-88, 2003.

BRUCE, Warwick, Bone Scintigraphy in Acetabular Labral Tears. *Clinical Nuclear Medicine*, v.29, n. 8, aug, 2004.

CLOHISY, J. C.; MCCLURE, J. T. Treatment of Anterior Femoroacetabular Impingement With Combined Hip Arthroscopy And Limited Anterior Decompression. *The Iowa Orthopaedic Journal,* v. 25, p. 164 - 171. 2005

CZERNY, Christian, et al Lesions of the acetabular labrum: Accuracy of MR imaging and MR arthrography in detection and staging**.** *Radiology.* v. 200, p.225-230, 1996.

FERGUSON, S.J. An in vitro investigation of the acetabular labral seal in hip joint mechanics *Journal of Biomechanics.* v. 36, p. 171-178, 2003.

GUANCHE, Carlos A; SIKKA, Robby S. Acetabular Labral Tears With Underlying Chondromalacia: A Possible Association With High-Level Running*. The Journal of Arthroscopic and Related Surgery*. v. 21, n. 5, p. 580-585. May, 2005.

HUFFMAN G. Russell, SAFRAN, Marc. Tears of the Acetabular Labrum in Athletes: Diagnosis and Treatment**.** *Sports Medicine and Arthroscopy Review* - v. 10, n. 2, 2002.

KELLY, Bryan T.; SHAPIRO, Gary S.; DIGIOVANNI, Christopher W.; *et al.* Vascularity of the Hip Labrum: A Cadaveric Investigation. *The Journal of Arthroscopic and Related Surgery*, v. 21, n. 1, p. 3-11, Jan 2005.

KIM, Y. T., AZUMA, H., The nerve endings of the acetabular labrum. *Clinical Related Orthopaedics and Related Research.* v. 320, p. 176-181. 1995

KONRATH, Gregory A. ANDREW J. HAMEL, STEVE A. *et al*. Ligament in Load Transmission in the Hip: The Role of the Acetabular Labrum and the Transverse Acetabular. *The Journal of Bone and Joint Surgery*. v. 80, n. 12, dec. 1998.

LEUNIG, Michael; PODESZWA, David; BECK Martin; *et al*. Magnetic Resonance Arthrography of Labral Disorders in Hips with Dysplasia and impingement, *Clinical Orthopaedics* . n. 418, Jan 2004.
LEWIS, Cara L; SAHRMANN, Shirley A. Acetabular Labral Tears *Physical Therapy*. v. 86, n. 1. Jan 2006.
MASON, J. B. Acetabular labral tears in the athlete. *Clinics in Sports Medicine* v. 20, p.779-790, 2001.
McCARTHY, Joseph C. *et al.* The role of labral lesions to development of early degenerative hip disease. *Clinical Orthopaedics And Related Research,* v. 1, n. 393, p. 25-37 dec, 2001
McCARTHY, Josef; NOBLE, Philip; ALUISIO, Frank V.; *et al*. Anatomy, Pathologic Features, and Treatment of Acetabular Labral Tears. *Clinical Orthopaedics And Related Research*, n. 406, 2003.
MURPHY, K., ROSS, Amy E.; JAVERNICK, Matthew A.; *et al.* Repair of the Adult Acetabular Labrum. *The Journal of Arthoscopic and Related Surgery*, v. 22, n. 5, p 567.e1-567.e3, Maio, 2006
NICHOLLS, Robert A. Intra-articular disorders of the hip in athletes. *Physical Therapy in Sport* v. 5 p. 17-25, 2004
NARVANI, A. A.; Tsiridis, E.; Kendall, S; *et al*. A preliminary report on prevalence of acetabular labrum tears in sports patients with groin pain. *Knee Surgery Sports Traumatology Arthroscopic* v. 11, p. 403-408, july, 2003.
SCHMERL, MChiro M.; POLLARD, Grad Henry; HOSKINS, MChiro Wayne. Labral Injuries of the Hip *Journal of Manipulative and Physiological Therapeutics*, oct 2005.
WENGER, Doris E.; KENDELL, Kurtis R.; MINER, Mark R. *et al.* Acetabular Labral Tears Rarely Occur in the Absence of Bony Abnormalities**.** *Clinical Orthopaedics And Related Research,* n. 426, 2004.
YKEDA, T. et al Torn acetabular labrum in young patients. *The Journal of Bone and Joint Surgery.* V. 70b N. 1 p. 13-16 (Jan) 1988.

Projeto de Extensão em Fisioterapia Desportiva
CEFID-UDESC
Rua Pascoal Simone, 358, Coqueiros - Florianópolis-SC-Brasil.
CEP: 88080-350.

ACETABULAR LABRAL TEARS AND PHYSICAL THERAPY - A LITERATURE REVIEW

Abstract

The acetabular labrum is a fibrocartilaginous rim. Labral tears normally presents symptoms like pain, click, and "giving way" sensation. The treatment for these injuries can be through by arthroscopic surgery or physical therapic approach. The objectives of rehabilitation are symptoms relief, to provide stability, proprioception and muscle imbalance. Plyometric training and sports activities are introduced in an advanced phase.

LÉSIONS DE LABRUM ACÉTABULAIRE ET DE PHYSIOTHÉRAPIE - UNE RÉVISION DE LITTÉRATURE

RESUMÉ

Le labrum acétabulaire est une structure fibrocartilagineux. Labral lésion présente symptômes comme la douleur, le clic, et la instabilité. Le traitement pour le ce des dommages peut être à travers par chirurgie arthroscopique ou approche physiothérapique. Les objectifs de la réadaptation sont soulagement de symptômes, pour fournir le déséquilibre de stabilité, de proprioception et de muscle. Le Pliometrique et les activités du specific sport sont présentées dans une phase avançée.

Mots Clés: Labrum Acétabulaire, Lésions, Physiothérapie.

LESIONES DEL LABRUM ACETABULAR Y LA FISIOTERAPIA - UNA REVISIÓN DE LITERATURA.

RESUMEN

El labrum acetabular es una estrutura fibrocartilaginosa. Lesiones Labrales presentan normalmente síntomas como dolor, clic articular , y la sensación de falseo. El tratamiento para estas lesiones están por cirugía artroscopica o por fisioterapia. Los objectivos de la rehabilitación son la relevación de síntomas, el trabajo de equilibrio, estabilidad, propriocepción y fortalecimiento. El entrenamiento de ejercicios pliometricos y de las actividades de los deportes se introducen en una fase avanzada.

Palabras Clave: Labrum Acetabular, Lesiones, Fisioterapia.

LESÕES DO LABRUM ACETABULAR E FISIOTERAPIA - UMA REVISÃO DE LITERATURA.

RESUMO

O labrum acetabular é uma borda fibrocartilaginosa. Dilacerações labrais normalmente apresentam sintomas como dor, estalido, e sensação de falseio. O tratamento para essas lesões pode ser através de cirurgia vídeo-artroscópica ou abordagem fisioterapêutica. Os objetivos da recuperação são alivio dos sintomas, prover estabilidade, propriocepção e reequilíbrio muscular. Treinamento pliométrico e atividades esportivas são introduzidos em fases avançados.

Palavras-chave: Labrum Acetabular, Lesões, Fisioterapia.