CARTILAGE INJURIES IN SPORTS

THE DILEMMA IS IN THE DETAIL

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Glossary:
AMIC – Autologous Matrix Induced Chondrogenesis,
BMS – Bone Marrow Stimulation,
BMAC – Bone Marrow Concentrate,
(M)ACI – (Matrix) Autologous Chondrocyte Implantation,
MSCs – Mesenchymal Stromal Cells,
OCA – Osteochondral Allograft,
OATS – Osteochondral Autologous Transfer,
PRP – Platelet Rich Plasma

INTRODUCTION

One of the most challenging practices in sports orthopedics and sports medicine is to treat musculoskeletal conditions that require a prolonged rehabilitation and a delayed return to play. A key example is the professional athlete suffering from a cartilage injury or pathology.

As sports medicine physicians, we are frequently confronted with debilitating cartilage injuries in our athletic population. The predominant reasons are:

- Increased participation in popular sports.
- Availability of imaging techniques like MRI.
- Increased incidence of surgery in athletes (such as ACL reconstruction and meniscal repair).
- High index of suspicion towards the pathophysiology of cartilage injury in the athlete.

CLINICAL DECISION MAKING

The athlete suffering from a cartilage lesion presents typically with pain, swelling, locking, catching or in a combination. Very often, this condition presents as a pseudo-instability and/or inability to move the articulation.

The etiology of the above symptoms is not always straightforward, but synovial inflammation caused by cartilage debris and inflammatory proteins are known to be key. Considering that cartilage is avascular and aneural, the presence of pain is a strong indicator of synovial inflammation and/or subchondral bone involvement. Additionally, mechanical symptoms (such as locking, catching, or pseudo-instability) are known to be linked with the intra-articular presentation of loose free bodies, cartilage flaps or exposed bone. The key to understanding why many athletes with MRI documented cartilage lesions are still able to engage in their sport, can be explained by the unique anatomical features of cartilage[1-3]. Current evidence shows that up to 14 % of athletes with cartilage lesions can present asymptomatic, even with full thickness lesions[1-5].

Especially in identified sports such as ice-hockey, volleyball, football and basketball[6-9], cartilage pathology can present as asymptomatic regardless of any loss of function or future surgical indication[10].

THE IDEAL PATIENT AND TREATMENT TIMING

In a systematic review, published in 2016, younger patients (with shorter preoperative duration of symptoms and without previous surgical interventions) were shown to have a better prognosis and earlier return to play after surgical treatment. Compliance to rehabilitation protocols and smaller size cartilage defects are also known to be positive prognostic factors[11].

Additionally, a systematic review in 2017 revealed that lesion size, athlete's age and concomitant surgical procedures are important predictors to consider as well12. On top of that, previous surgery was shown to be the single most predictive factor for return to the same sports level, together with younger age, traumatic lesions and absence of previous surgery[13].

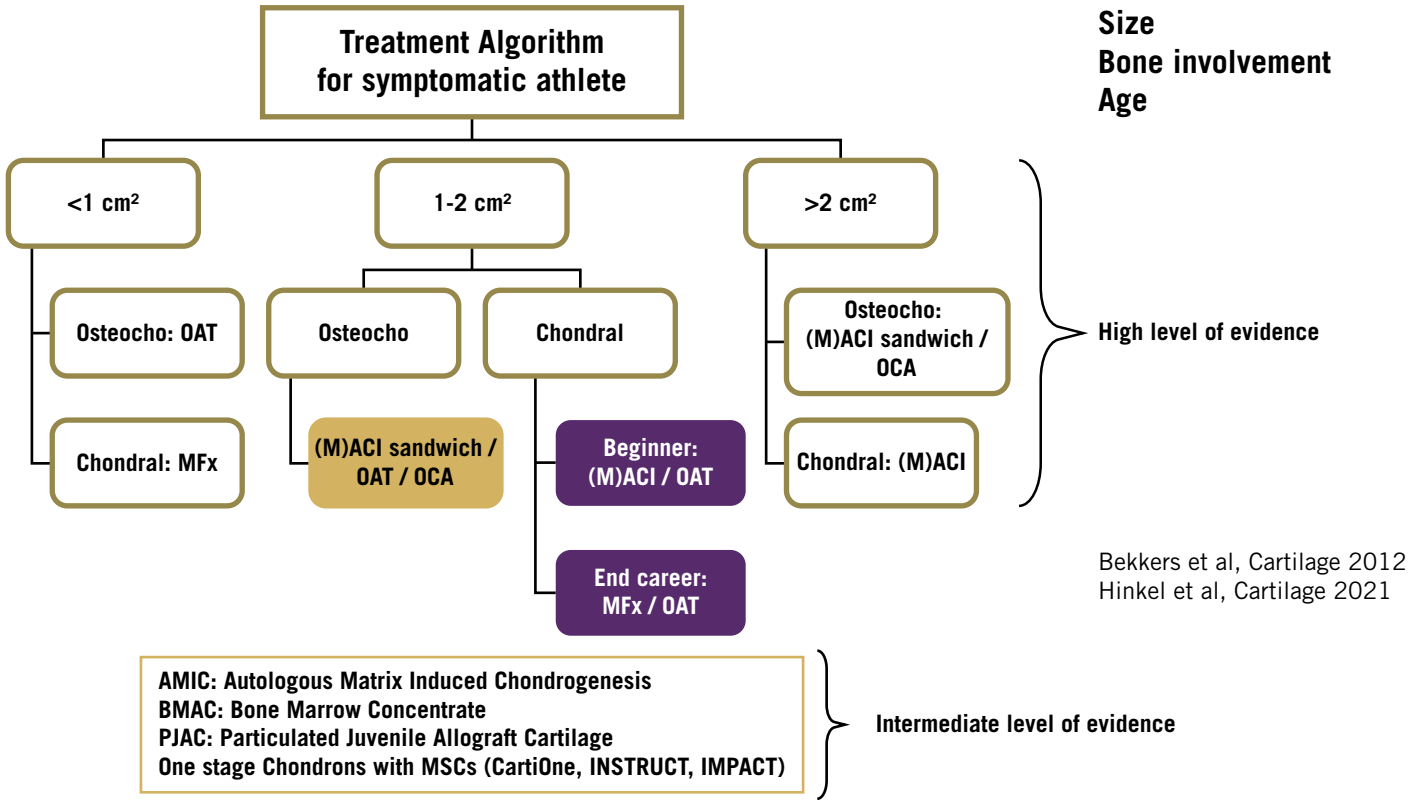

Figure 1: Treatment algorithm for sports cartilage injuries considering size, bone involvement and age. Suggestions from evidence.

Aa defect that is left untreated, or delayed (+1 year), or initially treated by means of bone marrow stimulation techniques, has shown the poorest of outcomes[14-17].

Predictors of a successful outcome are:

- Young patients with traumatic injuries (<25 yr in athletes, <30 yr in recreational athletes)
- Absence of delay in diagnosis and treatment (Within a year after the symptoms)
- Absence of previous surgeries or injuries
- Smaller mall defects (<2 cm²).

INDICATIONS FOR SURGERY

One of the challenges that the physician faces when dealing with an athlete suffering from a cartilage defect, is to determine whether the symptoms are correlated to the lesion. Many different parameters can play a role in the symptomatic condition of the athlete. Although cartilage defects are aneural, it is the pathophysiological lesion pathway that leads to pain and/or swelling. Therefore, conservative treatment, including physical therapy, medications, supplements, and intraarticular injections (Corticosteroids, HA, orthobiologics) are the first line approach and can assist the physician in the differential diagnosis.

This does not account however for defects with mechanical symptoms such as locking or catching. They often require a direct referral towards surgery.

Indications for surgery can be summarized by loss of function and/or disability, concomitant pathology, failure of nonsurgical treatment including intra-articular injections and clinical and/or radiological deterioration.

The most important parameter for the athlete is shown to be return to play. Any surgical shared decision making, or treatment algorithm will focus on this determinant factor[12]. Consequently, the timing and surgical treatment type are key factors to consider. Athletes with minor symptoms can sometimes try to delay treatment due to contractual or seasonal combined factors. However, once their performance is affected, the symptoms become more apparent or mechanical symptoms arise, surgery is indicated.

EVIDENCE-BASED TREATMENT ALGORITHM

The challenge remains to follow a common treatment algorithm for cartilage lesions in the athlete. The specific athletic needs and the multifactorial parameters require an individually tailored approach.

Predictive factors such as lesion characteristics, age and bony involvement are shown to be directly linked with early return to play and delayed rehabilitation timing[18,19,20].

CURRENT EVIDENCE

- Small defects do well with BMS or OATS (if one plug)[12,19] while AMIC and BMAC or One-Stage Chondrons and MSCs techniques are shown to improve outcome[21-25].
- Medium and large defects, (M)ACI and OATS or OCA provide longer durability and return to sport rates compared to BMS[26-37].
- When bone is involved OAT, OCA and (M)ACI (with Sandwich technique) yield better results .
- Return to sport rate ranges:(different indications as per the defect size)[11-12]:
  - OATS 89 – 93%,
  - OCA 88%,
  - ACI 82 – 84%,
  - BMS 58 – 75%.

FACTORS AFFECTING TREATMENT METHOD

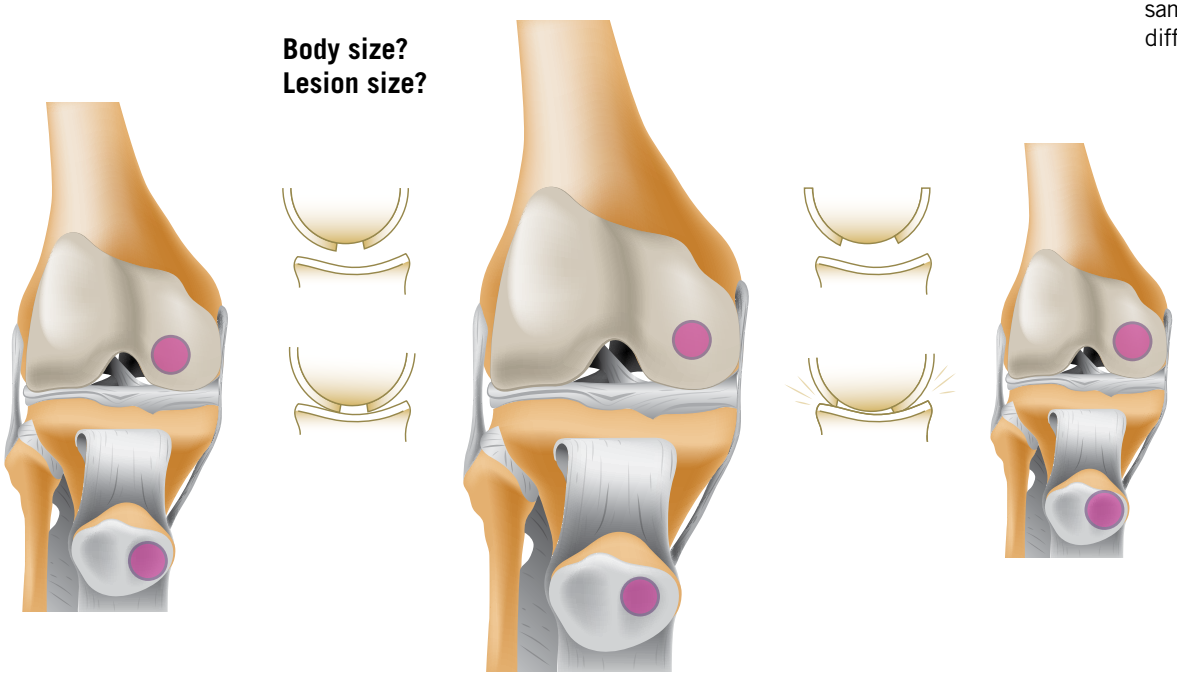

Figure 2: Size matters – same lesion dimensions in different sized knee joints.

The above presented research evidence justifies the treatment algorithm on surgical techniques according to the size of cartilage lesion, bone involvement and age of the athlete, as illustrated in Figure 1.

LESSONS LEARNED FROM SPORTS ENVIRONMENT REALITY

Debridement

Arthroscopic debridement is known to be a symptom-relieving technique with low morbidity, relative fast rehabilitation and return to play, low-cost with the disadvantage of providing only a short-term solution.

Especially in grade 2 lesions, good results can be obtained by debridement of the unstable cartilage fragments while creating smooth and stable defect edges[38]. Cartilage lesion debridement in the knee is shown to present with improved KOOS scores along the German Cartilage Registry, except for bigger lesions and combined partial meniscectomy[39].

The evidence on debridement indications are[40]:

- Partial thickness injury,
- Smaller lesions (2 to 3 cm²) in low demand individuals,
- Temporary solution during season competition
- Smaller lesions (2- 3 cm²) in late career athletes.

In a case series[41] on professional NFL players, the majority were able to return to play after chondroplasty - debridement for articular cartilage defects.

In a systematic review on RTP in football players who were treated by different surgical techniques, the authors reported a 100% return to play, approximately two and a half months postoperatively with evidence of fibrocartilage defect fill-up. However, 26% of the athletes developed additional cartilage lesions at a mean time of 1.6 years postoperatively, although in three out of four cases, the defect was found in another location[42,43].

Patients that were treated by a cartilage debridement, prior to a secondary ACI or Mosaicplasty procedure did not require the additional intervention in 27 % of cases[44].

Arthroscopic cartilage debridement (chondroplasty) is still a widely popular procedure[45-46] in sports surgery today ranging between 9 - 43%, with patellofemoral defects (49%) leading the indication as first line treatment[47,48].

Orthobiologics

The role of Orthobiologics in the treatment of athletic cartilage injuries can be summarized as follows:

1. Proof of safety in the use for cartilage injury and osteoarthritis

Current evidence provides the confirmation of safety with PRP and BMAC treatment options. Both look to cause minimal adverse effects (comparable or less) to similar injection therapies. Minor local inflammatory reaction with pain swelling or local skin reaction and low percentage of infection, bleeding or needle breakage are presented[49-53].

2. Clinical efficacy

Recent literature on intra-articular orthobiological injections presents with a reduction of symptoms without however any proof of tissue regeneration. These injections are considered symptom but not structure-modifying approaches. However, there is emerging evidence on the benefits of combining orthobiological treatments as adjunct to surgical cartilage repair[54-57].

3. Efforts to provide evidence

Although, Orthobiological injections are still considered unproven therapies for symptom modification in focal cartilage injuries of the knee, they can provide symptomatic relief in diagnosed Knee OA although its regenerative potential remains doubtful[58].

4. Non-Clinically driven decisions

In a survey among sports medicine physicians in the USA, orthobiological injections are used by a significant number of athlete doctors, with PRP being the most

popular and OA being the predominant pathology to be treated. Additionally, reasons other than clinical efficacy (especially competitor utilization) were also identified as part of the decision making[59].

ONGOING DILEMMA'S

Patient and lesion heterogenicity are commonly involved in the surgical decision-making process[12].

Several biases from the surgeon's perspective based on personal experience, familiarity with techniques and availability of technology need to be considered as well. Additionally, some remaining dilemma's need to be tackled further:

Size matters

A 2cm² MFC defect in a 1.65 m tall football player requires a different approach compared to a 2 cm² defect in 2.00 m tall Handball player (even in the exact same anatomic location) (Figure 2).

Site matters

A 2cm² lesion in the medial trochlea compared to a 2 cm² defect in the lateral trochlea, can result in a different symptomatology and impact on performance (Figure 3).

Bone involvement matters

A cartilage defect in the lateral femoral condyle of the knee (LFC) for example with: a) no bone edema, b) with bone edema, no tidemark abnormality, c) tidemark with waive appearance, and d) subchondral cyst, needs to be addressed in different ways.

Previous surgery complicates the decision-making process

Such as post-meniscectomy cartilage lesions.

Concomitant pathology needs to be addressed

ACL insufficiency, Trochlear dysplasia with patellar instability, Complex Lateral Meniscal tear, Varus alignment of the knee.

Timing is key

Early career stage athlete, long standing duration of symptoms (more than a year), unrealistic RTP expectations.

Seasonal challenges – Player role in the team

Differences in seasonal timeline, athlete level and individual expectations.

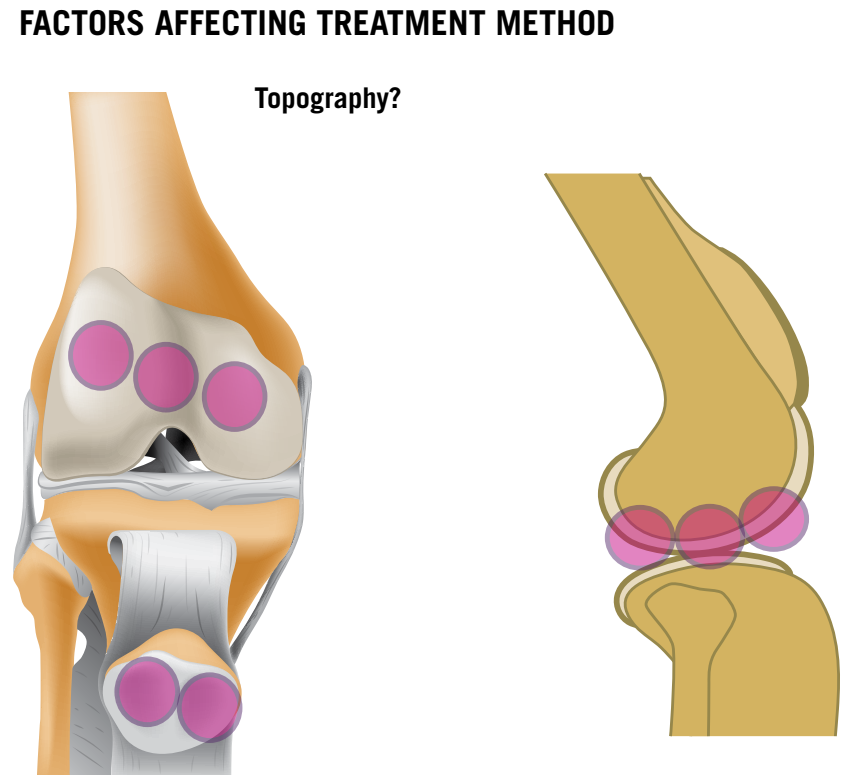

Figure 3: Site matters – same lesions in different anatomical site.

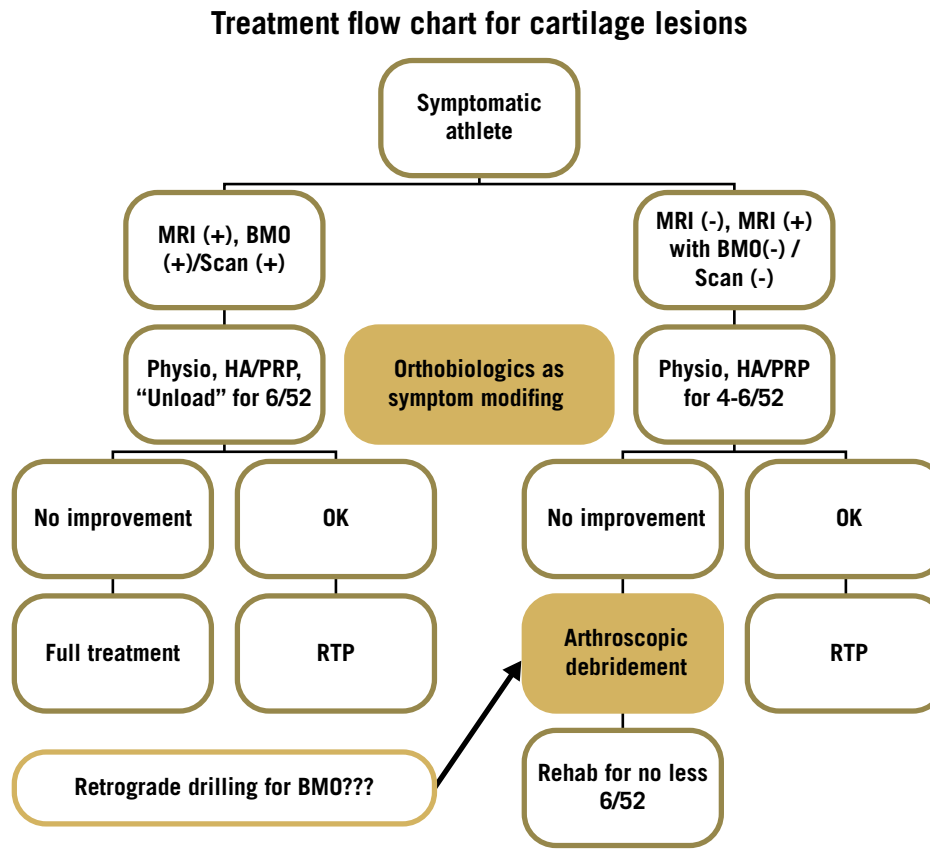

Figure 4: Treatment algorithm in symptomatic athlete - the Aspetar approach.

Image: Illustration.

All the above are daily examples of the challenges that a cartilage expert faces on a daily basis while dealing with athletes. Any surgical decision needs to be guided by scientific evidence and combined clinical expertise.

This shared decision-making process needs to remain centered towards the athlete – patient, while involving other stakeholders such as family members, agents, team officials etc. Realistic expectations need to be addressed after thorough expert evaluation together with provision of the scientific evidence as well as clinical experience and expertise.

Ultimately, any medical commitment to the athlete patient's condition goes all the way back to the ancient Greek Hippocratic oath «Ωφελεέειν, ή μη βλάπτειν», "First, do not harm".

The treatment of the symptomatic athlete with a cartilage defect is presented in the flowchart (Figure 4)

TAKE HOME MESSAGE

The treatment of cartilage lesions in the athlete remains a multi-factorial challenge despite a significant amount of new treatment options available.

An evidence-based history taking, clinical and radiological assessment and treatment algorithm allows the physician to indicate the correct and individualized athlete approach. Shared decision-making and realistic return to play protocols, tailored to the specific needs of the athlete are mandatory towards achieving the expected outcome.

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References

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