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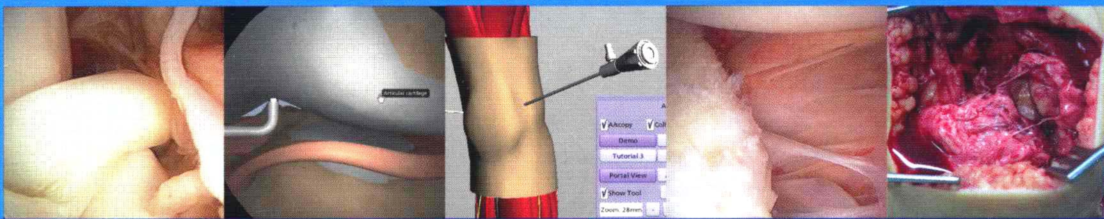

# ESSKA
# Instructional Course Lecture Book
## Amsterdam 2014

EUROPEAN SOCIETY OF SPORTS TRAUMATOLOGY, KNEE SURGERY AND ARTHROSCOPY
ESSKA

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重庆医科大学附属第一医院图书馆
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ISBN 978-3-642-53982-4 ISBN 978-3-642-53983-1 (eBook)
DOI 10.1007/978-3-642-53983-1
Springer Heidelberg New York Dordrecht London

Library of Congress Control Number: 2014937002

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ESSKA Instructional Course Lecture Book

# Preface

Dear ESSKA-members,

We are gratified to offer you this instructional course book that represents a latest update on the current knowledge on knee surgery, sports traumatology and arthroscopy. The book includes the contents of all the instructional course lectures. We acknowledge the great efforts of the authors that allowed us to present this book at the 2014 ESSKA congress.

In the light of the educational aspirations of ESSKA, it is a great pleasure to share this knowledge with all of you.

Stefano Zaffagnini
Roland Becker
Gino M.M.J. Kerkhoffs
C. Niek van Dijk
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## Part IV Orthopaedic Sports Medicine Review Course

# Part I

# Instructional Courses: Upper Limb

# Osteoarthritis in Young Patients and Current Treatments

# 1

Roman Brzóska, Adrian Błasiak, Polydoor E. Huijsmans, Anthony Miniaci, Giuseppe Porcellini, Wojciech Solecki, and Catherine van der Straeten

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## 1.1 Current Concepts on Shoulder Early Arthritis

Giuseppe Porcellini

The articular cartilage of the shoulder is not endowed with intrinsic repair abilities; therefore in the presence of diseases, like instability or cuff injury, even minor lesions may rapidly lead to early glenohumeral joint arthritis. The presence of cartilage lesions is not unusual even in young patients, and often they are found during arthroscopic procedures in several pathologic conditions. Less common conditions include glenoid dysplasia and osteochondritis dissecans. The varying thicknesses of the joint cartilage and the different resistance properties of the subchondral bone result in lesions of different depths and widths depending on the resistance offered by the

S. Zaffagnini et al. (eds.), *ESSKA Instructional Course Lecture Book*,
DOI 10.1007/978-3-642-53983-1_1, © ESSKA 2014



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articular surface. Minor cartilage lesions associated with rotator cuff or glenohumeral ligament damage will induce topographically different types of stress on the various areas of the articular surface. Recent and older research findings showed in the shoulder as in the knee, a correlation between cartilage wear and lesion site and between site and symptoms. Several conservative options available to manage shoulder arthritis are directed to alleviate pain, reduce inflammation, and, especially, halt or at least slow down the evolution of arthritis. Such therapies entail changes in lifestyle and systemic and topical drug administration. Viscosupplementation using hyaluronic acid may constitute a helpful treatment option in patients who have shoulder osteoarthritis with an intact rotator cuff, while lesser satisfactory results have been showed in case of rotator cuff tears or advanced osteoarthritis. Several surgical options are available to manage primary shoulder arthritis, including simple arthroscopic joint debridement and more complex techniques such as resurfacing using the fascia lata or meniscus, osteochondral autologous transplantation, resurfacing arthroplasty, and total arthroplasty.

## 1.2 Articular Cartilage Injuries (Clinical Treatment Options and Basic Science)

Anthony Miniaci

### 1.2.1 Objectives

At the end of this presentation, the participant will be able to:

- Understand the history and evolution of the arthroscope in the treatment of cartilage disorders
- Identify the efficiency of the various surgical techniques used to treat chondral defects and arthrosis and indications for each
- Have an understanding of the "newer techniques" available for the treatment of cartilage lesions
- Identify the limitations and strengths of various techniques used to treat chondral pathology
- Evaluate basic science of cartilage transplantation and clinical application and determine the relevance to their own clinical practice

### 1.2.2 Introduction

- Degenerative OA results in loss of function and motion and pain.
- No cure available yet.

### 1.2.3 Articular Cartilage Basic Science

- Primary cell: chondrocyte
- Function: decreases friction, distributes load, and exhibits stress shielding of solid matric components
- Avascular, aneural, and alymphatic with minimal reparative potential
- Nourished by synovial fluid at surface and subchondral bone at base
- Composition: water > collagen > noncollagen protein > cells
- Four types of articular cartilage:
  - Hyaline cartilage
  - Fibroelastic cartilage
  - Fibrocartilage
  - Elastic cartilage
- Zones of articular cartilage:
  - Superficial zone: collagen parallel to surface
  - Transitional zone: random fibers
  - Deep zone: collagen perpendicular to surface
  - Tidemark (subchondral bone and cancellous bone)

### 1.2.4 Treatment Options

- Nonsurgical
  - Decreased activity
  - Weight loss
  - NSAIDs
  - Physiotherapy aids
  - Steroids, viscotherapy
  - Platelet-rich plasma

- Surgery
  - Realignment procedures
  - Replacement
  - Arthrodesis
  - Arthroscopy – growing area

### 1.2.5 Arthroscopy

- Least invasive surgical approach
- As adjuvant to realignment procedure

**Types of Procedures**

Historical: lavage, debridement, abrasion, carbon fiber

Current practice

- Microfracture
- Osteochondral autograft transfer system (OATS)/ mosaicplasty
- Autologous chondrocyte implantation
- Focal resurfacing

#### 1.2.5.1 Lavage

- Beneficial effects
- Removes all irritants and floating debris
- 74 % good results (Sprague et al. [1])

#### 1.2.5.2 Debridement

- More aggressive than lavage.
- Removes loose chondral flaps.
- Beneficial effects (Magnuson [2]).
- Jackson demonstrated debridement better than lavage alone (Jackson et al. [3]).
- Generally good short-term results, 75 % at 2 years except:
  - Poor alignment
  - Duration of disease
  - Severe X-ray changes (Salisbury et al. [4]; Baumgartner et al. [5])

#### 1.2.5.3 Abrasion Arthroplasty

- In conjunction to debridement
- Stimulates fibrocartilage repair
- Open chondroplasty
- Arthroscopic
- Limited usefulness with questionable biomechanical integrity of fibrocartilage
- Perhaps no benefit over debridement alone

#### 1.2.5.4 Carbon Fiber Implantation

- Improves biochemical integrity of fibrocartilage repair
- Good early clinical results

#### 1.2.5.5 Microfracture

- Used to treat small (<2 cm) symptomatic lesions.
- Creating a contained lesion is imperative to create a stable base for filling defect.
- Involves removing calcified cartilage layer and perforation of subchondral plate to recruit mesenchymal stem cells into lesion; these cells differentiate into fibrocartilage.
- Procedure success is correlated with formation of stable blood clot that maximally fills defect.

**Outcomes**

- JKS: 103 prospective patients with 6-year follow-up
  - Procedure found to be technically simple with minimal complications.
  - Defects <4 $cm^2$ tend to do better.
- Steadman et al. [6]: 75 knees with average 11-year follow-up
  - 80 % of patients rated themselves "improved."
  - Multivariate analysis – age was a predictor of functional improvement.
- Mithoefer et al. [7]: 48 patients with 2-year follow-up
  - 67 % good to excellent results
  - Poor results correlated to:
    - BMI > 30
    - Poor fill on MRI
    - Symptoms >12 months
- Frank et al. [8]: 16 shoulders with average 28-month follow-up
  - Significant relief in pain and shoulder function with isolated, full-thickness chondral injuries (average 5.07 $cm^2$).
  - Three patients required subsequent procedures.
- Millett et al. [9]: 31 shoulders with average 47-month follow-up
  - Greatest improvement for smaller, isolated lesions of the humerus.
    - Worse results in patients with bipolar lesions
  - Six shoulders required additional surgery.

- Goyal et al. [10]: Systematic review of 15 level I and II studies
  - Patients with small lesions and low post-op demands had good clinical outcomes.
  - Beyond 5 years, failure after microfracture could be expected regardless of lesion size.
  - Younger patients had better clinical outcomes.

### 1.2.6 Osteochondritis Dissecans

Localized lesion characterized by separation of a segment of articular cartilage and its underlying subchondral bone.

#### 1.2.6.1 Incidence

- Poorly understood entity with no universally accepted etiology. True incidence unknown as often spontaneous resolution without presentation. Multiple joints reported but knee accounts for 75 % [11].
- Male/female 2:1 [11].

#### 1.2.6.2 Etiology

Two types based around physeal closure: juvenile OCD (5–15 year), adult OCD (15–50 year).

#### 1.2.6.3 Causes

- *Trauma*
  - *Direct* – as the posterolateral portion of the medial femoral condyle is affected in 85 % of knees, direct trauma is unlikely [12].
  - *Indirect* – odd facet of the patella articulating with area [12] and/or impingement of tibial spine on area in internal rotation [13].
- *Ischemia*
- *Defects of Ossification: Due to MED* [14]
  Abnormal end-artery theory of subchondral bone susceptible to emboli and ischemia has been suggested [15]. Other studies found blood supply of subchondral femur rich in anastomoses and the histology of loose bodies and resected fragments to NOT demonstrate evidence of OCD [16].
- *Genetic*
  Suggested that OCD may represent a mild subgroup of epiphyseal dysplasia [17]
  - Associations with Perthes and achondroplasia.
  - Familial relationships have been recorded.
  - Ossification defects (juvenile OCD).

#### 1.2.6.4 Presentation

Symptoms dependent on stage of lesion:

- Early – vague pain +/– swelling, activity related
- Late – if flap or loose body, catching and giving way
- Effusion, tenderness, and crepitus

#### 1.2.6.5 Imaging

- Plain X-ray.
- Tc-99m scan – previously described to identify and follow the course/recovery of OCD [18].
- MRI now is the best modality for diagnosis and following progress of lesion.

**MRI Classification**

Stage I – thickening of articular cartilage and low signal change
Stage II – articular cartilage breached and low signal rim behind fragment
Stage III – articular cartilage breached and high signal changes behind fragment
Stage IV – loose body (Dipaola)

**Arthroscopic Classification** [19]

Grade I – depressed subchondral fracture
Grade II – OC fragment attached by an osseous bridge
Grade III – a detached non-displaced fragment
Grade IV – displaced fragment

#### 1.2.6.6 Management

Controversy and confusion in literature are present as often works are based on small numbers, mix juvenile and adult cases, and few prospective trials have been performed.

**Juvenile OCD**

Lesions in knees with open physes usually heal with conservative treatment; those that do not are due to continued activity [18]. Ideal initial management is conservative.

Protected weight bearing/restriction of activities (90° casts), affected children often athletic and difficult to fully restrict. Try to avoid impact activities. Chances of success with nonoperative treatment decrease as time of physeal closure nears. 50 % of them will heal in 12 months.

Follow progress with serial MRI.

**Indications for Operative Intervention**

- Symptoms persist for 6–12 months despite adequate nonoperative treatment.
- Loose fragment.
- Progression of defect radiologically (MRI).
- Predicted physeal closure within 6–12 months.

**Adult OCD**

- Symptomatic lesions rarely heal with nonoperative measures.
- Lower tolerance for operative intervention after failure of conservative measures.

#### 1.2.6.7 Operative Intervention

- Stabilization/re-fixation of fragment.
- Clanton II, III, and selected IV.
- Excision of fragment/reconstruction of OCD defect (Clanton Type II/III (IV)).
  - Principles: rigid fixation, enhance blood supply, reestablish congruency
  - Arthroscopic drilling is controversial for most lesions, but good results have been reported in Juvenile Clanton II lesions [20].
- *Internal fixation: open or arthroscopic*
  - Pins [21]
  - K-wires [18]
  - Herbert screws [22]
  - Biodegradable rods [23]
  - Corticocancellous bone pegs [24]
- *Additional bone grafting under articular cartilage (Anderson)*

**OCD Defect**

- Poor results after excising lesion and leaving defect [18].
- Fibrocartilage is biomechanically less resilient than articular cartilage predisposing to degenerative changes [25].

**Fragment Fixation Technique** [26]

(a) *Clanton and DeLee Type II and III Lesions*

- Unstable plugs that fail conservative management
- Can be used in prepubertal and postpubertal patients
- Theoretical considerations:
  1. Stabilize fragment with K-wire, and remove after fixed with one or two plugs.
  2. Drill holes – stimulates blood supply.
  3. Press fit 3.5 or 4.5 mm plugs results in stable fixation.
  4. Place peripheral plugs between native vascular bone and fragment so that healing of fragment can occur.
  5. Plug serves as a source of bone graft.
  6. Cartilage cap on "plug" restores articular surface so end result will have continuous articular cartilage surface.
  7. Central plug should be used for ultimate stability. This should be long enough to traverse OCD fragment into underlying vascular bone.

     Measure depth preoperatively.

     Ultimately provides blood supply – drilling, stability-interference fixation, bone grafting of fibrous layer, and congruent articular cartilage surface.

     Clinical results > 20 cases of OCD, 100 % healing rates, no additional fixation, return to activity and sports by 3–4 months, and complete healing by 6–9 months.
  8. *Type IV lesions*: where suitable for fixation- debride bed. Initial stabilization with K-wires is required before plug insertion.

(b) *Chronic Lesions*

Indications for treatment

- Symptomatic defect (trial of debridement)
- Stable knee
- Normal biomechanical alignment
- Minimal degenerative changes

**Defect Reconstruction**

- Large osteochondral grafts
- Autografts [27]
- Mosaic autografts [26, 28, 29]

- Allografts [30]
- Chondrocyte culture implantation – not as effective as a result of bone defect

### 1.2.7 Filling of Defect: Mosaicplasty Reconstruction

**Technique** – when fragment is lost, BE CAREFUL.

- Aim to recreate joint curvature and congruence.
- Fill defect with grafts from the periphery inwards. This allows for assessment of joint curvature and for central graft support.
- Central pegs will need to be longer to account for the greater height of curvature and depth of crater.
- Need to sit central plugs higher, since you are reconstructing both a bone and cartilage defect.
- If plugs in center are not higher, then reconstruction will be flat.
- Measure center of defect on MR preoperatively to determine size and length of plugs.
- Graft harvest from edge of the patellofemoral joint in both knees as necessary (10–12 4.5 mm grafts from each knee).

**Postoperative Treatment**

- Allow knee motion but strict non-weight bearing for 6 weeks.

**Focal Traumatic Osteochondral Lesions**

- Similar principles to OCD.
- In acute lesions can use plugs to fix osteochondral lesions.
- Femoral condyles the easiest.
- Tibial lesions difficult, not practical.
- Trochlear lesions usually require arthroscopy.

**Donor Sites**

- Plug harvest location is important.
- Keep out tibiofemoral joint.
- 5 mm on periphery of patellofemoral joint is optimal (less contact) and avoids reciprocal arthrosis.
- Large plugs, >5 mm fill incompletely, with fibrosis tissue.
- Causes reciprocal OA in areas of weight bearing contact.

**Recipient Sites**

- Hole preparation is crucial.
- Preserve bone stock, need stable construct.
- Drilling holes cause thermal necrosis.
- Dilating holes preserve bone stock and reduce thermal necrosis.
- Press fit plug to hole for stable construct.
- Bottom out hole to avoid subsidence and cyst formation.
- Fill defect with as much articular cartilage as possible, reduces percentage of fibrocartilage.
- Put plugs even with surrounding articular surface, too proud causes loosening and cyst formation, recessed covered with fibrocartilage.

**Graft Harvest and Delivery**

*Harvest*: do not use power trephine for harvest, causes cell necrosis. Multiple small plugs allow for better reconstruction of curved surface. After harvest inspect plug integrity, fractures, and obliquity. Measure depth of plug.

*Plug delivery*: press fit plugs, flush with surrounding articular surface, and bottom out hole; manual or light pressure only to insert plugs; impaction causes cell necrosis; reconstruct curved surfaces (center higher than periphery); tendency is for flat reconstructions.

**Outcomes**

- Histologically Type II collagen preserved; bone healing of plugs provides solid structure.
- Subchondral cyst formation is a concern.
- Hangody and Fules [31]: The largest series of mosaicplasties (831) for grade III or IV chondral lesions.
- Good to excellent results for 92 % femoral lesions, 87 % tibial lesions, and 79 % patellofemoral lesions.
- 80 % of second-look arthroscopies in 85 patients showed congruent articular cartilage surfaces and histologic evidence of transplanted hyaline cartilage.

- Ozturk et al. [32]: 19 patients with grade IV lesions.
- 85 % rate of good-to-excellent results at 32-month follow-up.
- MRI showed excellent fill and congruency < 1 mm without fissuring or delamination in 84 % of cases.
- Miniaci and Tytherleigh-Strong [26]: Mosaicplasty in unstable OCD lesions.
- Twenty knees were studied and scored clinically normal by 18 months.
- Serial MRI showed healing of osseous lesion by 6 months, continuous articular cartilage by 9 months.
- Kircher et al. [33]: OATS in the shoulder, seven patients at 9-year follow-up.
- Improved mean Constant scores; Lysholm score remained excellent.
- Significant progression of OA.
- Not related to size, number of plugs, or Constant score.
- MRI showed congruent joint surface on all except one shoulder.
- No further surgeries needed.

**Outcomes Compared to Microfracture**

- Krych et al. [34]: Level III, 96 patients at 5-year follow-up
  - Mosaicplasty and microfracture resulted in significantly improved general health and knee function scores.
  - Higher activity level post-op with mosaicplasty compared to microfracture.
- Gudas et al. [35]: Level I, 60 patients at 10.4-year follow-up
  - OATS technique allowed for higher rate of return to and maintenance of sports at pre-injury level compared with microfracture.
- Ideal patient is a young active patient with full-thickness chondral defect between 2 and 10 $cm^2$ that is surrounded by stable and healthy cartilage.
  - Useful in treating injuries that have failed debridement
  - Best suited for unifocal femoral condyle lesions but may be used for multifocal disease
- 2-stage procedure to implant chondrocytes to produce repair tissue that most closely replicated the composition and function of normal hyaline cartilage, restoring the durability and function of the joint articular surface:
  - Stage 1: arthroscopic biopsy of healthy chondral tissue
  - In vivo culture expansion
  - Stage 2: chondrocyte implantation

### 1.2.8 Autologous Chondrocyte Implantation

- First generation: periosteal patch utilized that leads to high reoperation rates.
- Second generation: utilizes a specialized bilayer collagen membrane instead of periosteal flap to cover implanted chondrocytes within the treated chondral defect.
- Third generation: three-dimensional scaffold acts as a carrier for implanted chondrocytes.

**Outcomes**

- Peterson et al. [36]: 61 patient at average 7.4-year follow-up
  - Isolated femoral condyle or patella.
  - After 2 years, 50 of 61 patients had good or excellent results.
  - At 5–11 years, 51 of 61 had good or excellent results.
  - 8/12 biopsies showed hyaline cartilage.
- Micheli et al. [37]: 32 patients at average 4.3-year follow-up after ACI of the distal femur
  - Mean changes in scale scores measuring overall condition, pain, and swelling were 3.8, 4.1, and 3.4 respectively.
  - One patient had implantation failure.
- *AJSM*: systematic review of level I and II studies of ACI versus other restoration/repair techniques
  - ACI versus MF
    - 3/7 studies found better clinical outcomes in ACI at 1–3 years.

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