# بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

# شبكة المعلومات الجامعية
# التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

# جامعة عين شمس

## التوثيق الإلكتروني والميكروفيلم

## قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

## يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

MONA MAGHRABY

# Comparison of a routine magnetic resonance imaging & T2* mapping of articular cartilage in knee osteoarthritis

Thesis
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BY


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# قالوا

## سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

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Dr. Shaimaa Shawky

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# List of Abbreviations

| Abb. | Full term |
| --- | --- |
| OA | Osteoarthritis |
| MRI | Magnetic resonance imaging |
| 3.0T | 3 Tesla |
| 3 D | Three dimensional |
| PXR | Plain x-ray |
| ROI | Regions of interest |
| PD | Proton density |
| FSE | fast spin-echo |
| SPGR | spoiled gradient-echo sequence |
| ACL | Anterior cruciate ligament |
| PCL | Posterior cruciate ligament |
| PG | Proteoglycan |
| GAG | Glycosaminoglycan |
| ECM | Extra-cellular matrix |
| TIM | Total image matrix |
| d-GEMERIC | Delayed Gadolinium enhanced MRI of cartilage |

# INTRODUCTION

Osteoarthritis (OA) is multi-tissue, multi-factorial disease and a worldwide major cause of disability resulting from reduced joint mobility and function. Progressive loss of articular hyaline cartilage is one of the hallmark features of OA, initiated by loss of proteoglycans and an increase in water contents, followed by loss of type II collagen and a change in collagen fiber orientation ***(Apprich et al., 2012)***.

OA progression is usually graded based on plain radiographs, using joint space width, continuity of bony contours, and the presence and size of osteophytes as criteria. However these criteria do not help for detection of early cartilage changes. As articular cartilage has only limited capability of self-repair, an early diagnosis of cartilage degeneration and a sensitive non-invasive diagnostic tool are highly desirable ***(Apprich et al., 2012).***

With advances in joint preservation surgery that are intended to alter the course of osteoarthritis by early intervention, accurate and reliable assessment of the articular cartilage status is critical ***(Hesper et al., 2014).***

Magnetic resonance (MR) imaging has evolved rapidly owing to technical advances and the application of these to the field of clinical research. Cartilage imaging certainly is at the forefront of these developments ***(Roemer et al., 2011).***

The development of magnetic resonance imaging has revolutionized the ability of physicians to directly assess the articular cartilage with a non-invasive modality. Despite this advancement, cartilage lesions, such as thin fissures, cartilage flaps, and shallow defects, remain difficult to be accurately evaluated with standard MRI (***Reed et al., 2013).***

T2* mapping is a good alternative because it combines the benefits of biochemical cartilage evaluation with remarkable features including short imaging time and the ability of high-resolution three-dimensional cartilage evaluation without the need for contrast media administration or special hardware ***(Hesper et al., 2014).***

# Aim of the work

To evaluate the detection and the size of the cartilage lesions in T2* mapping as compared to standard magnetic resonance imaging in knee osteoarthritis.

# Anatomy of the knee joint

The knee joint is the largest and most complex joint in the human body; it can be conceptualized as two joints; tibio-femoral and patello-femoral articulations, stabilized by a combination of static ligaments, dynamic muscular forces, joint load, bony topography, and meniscocapsular aponeurosis **(Flandry & Hommel, 2011)**.

## Gross Anatomy

The complex synovial knee joint plays an important role as it provides a range of movements (flexion, extension, and small degree of medial and lateral rotation) while supporting the body's weight. To do so, it is composed of different tissues such as bones (femur, tibia, and patella), strong ligaments, joint capsule, bursae, and articular fat pads **(Oliveira et al., 2016).**

The structures in the knee joint will be discussed under the following sections:

- Osseous structures.
- Articular surfaces.
- Soft tissue structures including: menisci, ligaments, joint capsule, synovial membrane, muscles, bursae, and neuro-vascular structures.

## Osseous anatomy:

The knee is consists of four bones: the femur, tibia, fibula, and patella. All of them are functional in the knee joint, except for the fibula.

- The Femur is the longest and strongest bone in the human body, its proximal end forms the head of the femur, which projects antero-supero-medially to articulate with the acetabulum, the distal end is wider and forms a double condyle that articulates with the tibia and patella.

  The tibia articulates with the lateral and medial femoral condyles, while the patella articulates anteriorly in the inter-condylar fossa (trochlear groove) **(Kishner, 2017)**.
- The Tibia which lies distal to the femur and medial to the fibula, the primary function of it is to transfer the body weight across the knee and to the ankle. Its proximal end consists of medial, lateral condyles, and intercondylar area, that articulates with the medial and lateral condyles of the femur. Distally, the tibia articulates with the ankle. The distal and proximal ends of the tibia articulate with the fibula. In addition, also the shaft of the tibia and fibula are connected with an interosseous membrane to form a syndesmosis joint **(Kishner, 2017)**.