

Department of Social Protection

# Osteoarthritis

# Contents

---

<b>1. Overview and Definition of Osteoarthritis</b>	<b>4</b>
1.1 Overview of Osteoarthritis	4
1.2 Definition of Osteoarthritis	5
1.3 International Classification of Diseases; 10 <sup>th</sup> Edition (ICD-10) Classification	5
<b>2. Epidemiology</b>	<b>8</b>
<b>3. Aetiology</b>	<b>9</b>
3.1 The Aetiology of Osteoarthritis	9
3.1.1 Age and Obesity	9
3.1.2 Genetic Factors	9
3.1.3 Biomechanical Factors	9
3.1.4 Occupational Factors	10
3.1.5 Nutritional Factors	10
3.2 Secondary Osteoarthritis	10
<b>4. Diagnosis</b>	<b>12</b>
4.1 Overview	12
4.2 Clinical Features	12
4.2.1 Clinical Features of Osteoarthritis of the Hand	13
4.2.2 Clinical Features of Osteoarthritis of the Hip	13
4.2.3 Clinical Features of Osteoarthritis of the Knee	13
4.3 Other History	14
4.3.1 Joint Pain	14
4.3.2 Stiffness	14
4.3.3 Deformity	15
4.4 Physical Examination	15
4.5 Investigations	15
4.5.1 Radiological imaging	15
4.5.2 Magnetic Resonance Imaging	16
4.5.3 Laboratory investigations	16
4.5.4 Other Assessments	16
<b>5. Differential Diagnosis</b>	<b>17</b>
5.1 Differential Diagnosis	17
5.1.1 Inflammatory arthritis	17

5.1.2 Other Generalised Differential Diagnoses	17
5.1.3 Differential Diagnoses for Osteoarthritis of the Hand	18
5.1.4 Differential Diagnoses for Osteoarthritis of the Hip	18
5.1.5 Differential Diagnoses for Osteoarthritis of the Knee	18
5.2 Comorbidity	19
<b>6. Treatment</b>	<b>20</b>
6.1 Treatment Options for Osteoarthritis	20
6.1.1 Treatment Goals	20
6.2 Non-Pharmacological Therapies	20
6.2.1 Patient Education	20
6.2.2 Weight Loss	21
6.2.3 Exercise Programmes and Physical Therapy	21
6.2.4 Footwear, Bracing and Walking Aids	21
6.2.5 Acupuncture	22
6.3 Pharmacological Therapies	22
6.3.1 Analgesia	22
6.3.2 Glucosamine Sulphate	23
6.4 Surgical Interventions	23
6.4.1 Joint Replacement	23
<b>7. Prognosis (Main Prognostic Factors)</b>	<b>26</b>
7.1 Overview	26
7.1.1 Osteoarthritis of the Small Bones of the Hand	26
7.1.2 Osteoarthritis of the Hip	26
7.1.3 Osteoarthritis of the Knee	26
<b>8. Information Gathering at the In Person Assessment</b>	<b>27</b>
<b>9. Analysis of Effect on Functional Ability</b>	<b>29</b>
9.1 Indicators of Ability/Disability	29
9.2 Ability/Disability Profile	33
<b>10. Summary of Scheme Criteria</b>	<b>34</b>
<b>11. References and Bibliography</b>	<b>35</b>

# 1. Overview and Definition of Osteoarthritis

---

## 1.1 Overview of Osteoarthritis

Osteoarthritis (OA) is the most common form of arthritis, presenting as a clinical syndrome which affects joints, resulting in pain, functional limitation and reduced quality of life (NCCC, 2008). The condition has a greater affect on mobility than any other medical condition in people aged over 65, particularly in the actions of walking and climbing stairs (Guccione et al., 1994, Felson et al., 2000). The prevalence of this condition is increasing dramatically, reflecting an aging population and a rise in the prevalence of obesity (Hunter, 2007). The prevalence of osteoarthritis is expected to double by 2020 (CDC, 1994; Bradley and DesMeules, 2003)

Despite a wealth of research, mainly into pharmacological and surgical therapies (Hunter, 2009), osteoarthritis is not well understood as a disease (Hunter, 2007). The condition was traditionally thought to be a disease of articular cartilage resulting in erosion of tissue that was purely mechanical in origin. However, the condition is now thought to be much more complex, with suggestions that the disease could originate from a variety of causes including metabolic factors, genetic factors, trauma or injury, bone and joint malfunctions or a combination of these factors (Oben et al, 2009, Hunter, 2009). Presentation of this condition is extremely varied, dependent on the individual and the site of the disease, but it is thought to affect nearly 100% of the population in at least one site by the eighth decade of life, although in many of these cases the condition is asymptomatic, and only recognisable radiographically (Scott, 2009). It is present in every population world-wide although geographic differences do occur.

There is no widely accepted definition of osteoarthritis, but it may be regarded as a disorder of synovial joints involving degeneration of articular cartilage with involvement of the subchondral bone. The suffix, “-itis”, is a misnomer as it implies an inflammatory component, which is not a necessary aspect of the condition.

Osteoarthritis can occur in any joint, but in Europeans the most commonly affected sites are the knees, hips, and the small joints of the hands. Osteoarthritis of the spinal apophyseal joints is also not uncommon.

Diagnosis of the condition is made through assessment of clinical features in many individuals, and a working diagnosis can be formed without radiological confirmation (see *section 4: diagnosis*). This is because there is poor correlation between symptomology and radiographically detectable changes in joint structure (NCCC, 2008). Recent studies involving magnetic resonance imaging (MRI) \_have suggested this is due to the fact that radiographic images may only indicate osteoarthritic disease once it has reached an advanced stage (Hunter et al, 2004, Reichenbach et al. 2008).

*Whilst this protocol covers general principles for osteoarthritis which can be applied to presentations of osteoarthritis in any joint, specific information is also provided for the three most commonly affected sites – the joints of the hands, knees and hips.*

## 1.2 Definition of Osteoarthritis

There is no universally recognised definition for osteoarthritis (Dawson et al, 2004). The National Institute for Health and Clinical Excellence (NICE) defines osteoarthritis as a synovial joints disorder that results in focal areas of damage and loss to the articular cartilage accompanied by bone remodelling and formation of osteophytes (new bone at the joint margins) (NCCCC - National Collaborating Centre for Chronic Conditions, 2008). This is suggested to occur due to a process of synovial joint repair as a result of trauma of one form or another. This process usually occurs in an effective manner to compensate for the original trauma, but in osteoarthritis does not occur correctly, either due to a compromised repair process, or because the original trauma continues to occur (for example in osteoarthritis due to load such as obesity, where the joint continues to support a heavy load) (NCCC, 2008).

An alternative definition is provided by Eyre (2004) who defines osteoarthritis as a process which 'occurs when the dynamic equilibrium between the breakdown and repair of joint tissues become unbalanced'.

## 1.3 International Classification of Diseases; 10<sup>th</sup> Edition (ICD-10) Classification

The World Health Organisation, in the 10<sup>th</sup> Edition of the International Classification of Diseases (ICD-10) (World Health Organisation, 2007); uses osteoarthritis as a synonym for arthrosis or osteoarthrosis and applies the following diagnostic classification:

**M15:** Polyarthrosis - arthrosis with mention of more than one site (*Excludes Spinal Arthrosis – see M47*)

- M15.0 Primary generalized (osteo)arthrosis
- M15.1 Heber den's nodes (with arthropathy)
- M15.2 Bouchard's nodes (with arthropathy)
- M15.3 Secondary multiple arthrosis , Post-traumatic polyarthrosis
- M15.4 Erosive (osteo)arthrosis
- M15.8 Other polyarthrosis
- M15.9 Polyarthrosis, unspecified , Generalised osteoarthritis NOS

**M16:** Coxarthrosis – osteoarthritis of hip

- M16.0 Primary coxarthrosis, bilateral
- M16.1 Other primary coxarthrosis, NOS, unilateral
- M16.2 Coxarthrosis resulting from dysplasia, bilateral

- M16.3 Other dysplastic coxarthrosis, dysplastic coxarthrosis
- M16.4 Post-traumatic coxarthrosis, bilateral
- M16.5 Other post-traumatic coxarthrosis
- M16.6 Other secondary coxarthrosis, bilateral
- M16.7 Other secondary coxarthrosis
- M16.9 Coxarthrosis, unspecified

**M17:** Gonarthrosis - arthrosis of knee

- M17.0 Primary gonarthrosis, bilateral
- M17.1 Other primary gonarthrosis
- M17.2 Post-traumatic gonarthrosis, bilateral
- M17.3 Other post-traumatic gonarthrosis
- M17.4 Other secondary gonarthrosis, bilateral
- M17.5 Other secondary gonarthrosis
- M17.9 Gonarthrosis, unspecified

**M18:** Arthrosis of first carpometacarpal joint

- M18.0 Primary arthrosis of first carpometacarpal joints, bilateral
- M18.1 Other primary arthrosis of first carpometacarpal joint
- M18.2 Post-traumatic arthrosis of first carpometacarpal joints, bilateral
- M18.3 Other post-traumatic arthrosis of first carpometacarpal joint
- M18.4 Other secondary arthrosis of first carpometacarpal joints, bilateral
- M18.5 Other secondary arthrosis of first carpometacarpal joint
- M18.9 Arthrosis of first carpometacarpal joint, unspecified

**M19:** Other arthrosis

- M19.0 Primary arthrosis of other joints
- M19.1 Post-traumatic arthrosis of other joints
- M19.2 Other secondary arthrosis
- M19.8 Other specified arthrosis

- M19.9 Arthrosis, unspecified

**M47:** Spondylosis, including arthrosis or osteoarthritis of spine, degeneration of facet joints

- M47.0+ Anterior spinal and vertebral artery compression syndromes ( G99.2\* )
- M47.1 Other spondylosis with myelopathy
- M47.2 Other spondylosis with radiculopathy
- M47.8 Other spondylosis, cervical, lumbosacral, thoracic
- M47.9 Spondylosis, unspecified.

## 2. Epidemiology

---

The epidemiology of arthritis is problematic (NCCC, 2008) both due to detection of the disease itself, and due to the varying definitions and diagnostic criteria which can be applied to the condition (Dawson et al, 2004). Although structural changes indicating osteoarthritis can be found in radiographic studies in most individuals above the age of 55 in Ireland, the condition is often asymptomatic (Arthritis Ireland, 2009).

However X-ray evidence alone is not sufficient to make a diagnosis. 12% of adults between the ages of 24-74 have radiological features of osteoarthritis in at least one joint (Lawrence et al, 1989) while conversely post-mortem studies have shown that, even in the presence of significant degeneration, joints can exhibit a normal X-ray appearance.

Arthritis is one of the significant causes of disability in Ireland (Arthritis Ireland, 2009). Significant disease (i.e.: symptomatic – usually in terms of pain) affects 10-20% of people (Scott, 2009) in populations worldwide. Almost 0.75 million individuals in Ireland are affected by some form of arthritis, the majority with osteoarthritis and approximately 40,000 individuals with rheumatoid arthritis. This equates to 1 in 6 - approximately 34% of all males and 23% of all females in the Irish population (Arthritis Ireland, 2009), and is roughly comparable with the UK prevalence of the condition where it is estimated that 8.5 million individuals in the UK experience some form of arthritis related joint pain (NHS Institute for Innovation and Improvement, 2008).

Over 30% of all GP visits in Ireland relate to arthritic conditions.

Until the age of 50, osteoarthritis is more prevalent in men than women – often due to sports related trauma or injury. The prevalence reverses with age, with women becoming more affected (particularly by osteoarthritis of the hand) than men.

Most forms of osteoarthritis are common in all populations; however osteoarthritis of the hip is almost twice as common in European populations as in Asian, Black or East Indian populations (Nevitt et al, 2002).

Prevalence of the condition increases with age, and overall prevalence rates are increasing in Ireland, as with the majority of Europe. This is representative of an aging population, and also an increasing prevalence of obesity (one of the predisposing factors for osteoarthritis) and poor levels of physical fitness (NCCCC, 2004).

## 3. Aetiology

---

### 3.1 The Aetiology of Osteoarthritis

Osteoarthritis is a heterogeneous disorder for which the exact cause is unknown. The condition is thought to consist of a group of overlapping distinct diseases which may occur in response to a variety of different biological and mechanical factors including metabolic, genetic or hereditary predisposition, age, physical factors such as obesity, and environmental factors (Oben et al, 2009, Hunter, 2009). A single factor has not been identified as wholly responsible, and many contributing factors are best regarded as “associations”. There is usually interplay of different contributing factors.

It is also thought the normal process of repair which takes place within a joint may be a contributing factor, in that the normal process is either altered for some reason (for example a genetic factor) or is unable to cope with either the degree of trauma, or the fact that trauma may be ongoing (e.g. in a joint which has become damaged due to unusual load such as knee joint in a very obese person) (NCCCC, 2008).

#### 3.1.1 Age and Obesity

Age is one of the strongest determining factors, with radiographic change in joints being almost universal in older people but only symptomatic in 10-20% of individuals (Scott, 2009).

Obesity is a modifiable risk factor which is having the greatest affect on increasing prevalence in recent years (Coggon et al. 2001; Hunter, 2009). This has the greatest effect on the joints of the knees, but is also linked to the development of osteoarthritis of the hip.

The exact mechanisms by which age and obesity act as predisposing risk factors for osteoarthritis are not known. Although there is an obvious link in terms of obesity and weight bearing, this does not explain why obesity should be a risk factor in the development of osteoarthritis in the small bones of the hand for example.

#### 3.1.2 Genetic Factors

Genetic factors have involvement in the development of hand, knee and hip osteoarthritis, as the heritability estimates for these conditions is high (40-60%) (NCCCC, 2008). Specific gene involvement is not known. It is thought that there is no single gene which accounts for the structural component of the cartilage that could result in osteoarthritis; however, mutations in the vitamin D receptor gene which is near the locus for type II collagen (COL2A1) is considered a strong candidate (Felson et al, 2000).

#### 3.1.3 Biomechanical Factors

Biomechanical factors also include the following (NCCCC, 2008):

- Joint trauma
- Occupational (see below)
- Relaxed muscle strength
- Joint laxity, hyper-flexibility of joints
- Mal-alignment of joints, congenital deformities.
- High bone density is a risk factor for the development of osteoarthritis, but low bone density is a risk factor for the progression of the condition.

The combination of these various factors results in the development and the progression of the disease (Hunter and Felson, 2006). However the variability of these factors leads to the wide range of presentations of the condition in different individuals.

### 3.1.4 Occupational Factors

There are a number of occupations which are linked with osteoarthritis due to the nature of heavy physical work involved. For example farming and other occupations where the lifting of heavy loads (>25kg) is involved are a risk factor for the development of osteoarthritis of the hip (Lieveuse et al, 2001), drill workers are at risk of development of osteoarthritis of the hand (Felson, 2000), and it is thought that athletes have an increased risk of osteoarthritis of the knee and hip due to high levels of practice and repetitive injury, although evidence to support this may not be conclusive (Lequesne, et al, 1977; Lieveuse et al, 2003).

Occupations which involve kneeling and squatting while undertaking heavy manual tasks (such as lifting or shovelling – as found in mining) have a risk which is more than doubled of developing osteoarthritis of the knee (Industrial Injuries Advisory Council, 2008).

### 3.1.5 Nutritional Factors

Poor or sub-optimal intake of vitamins C and D are thought to play a part in both development and progression of osteoarthritic disease (Bhalla et al, 1987; McAlindon et al, 1996).

## 3.2 Secondary Osteoarthritis

There are a number of specific conditions have been associated with osteoarthritis. When such a disease is identified, the resultant osteoarthritis is said to be “secondary”.

These conditions include:

- trauma

- septic arthritis
- inflammatory arthritis (rheumatoid, psoriatic)
- crystal deposition disease (gout, pseudogout)
- childhood hip disease (developmental dysplasia, Perthes, slipped upper femoral epiphysis)
- previous meniscectomy or ACL insufficiency in the knee
- avascular necrosis (which may be idiopathic or secondary to steroid use)
- radiation damage
- haemophilia
- haemochromatosis
- alkaptonuria (ochronosis)

## 4. Diagnosis

---

### 4.1 Overview

As previously described, the symptoms experienced by an individual with osteoarthritis, may not equate with radiological findings. The assessment and diagnosis of osteoarthritis is therefore a clinical one based on the individual's signs and symptoms – there is no standard test either pathological or radiological that can definitively diagnose the condition (Kokebie and Block, 2008), although such investigations may confirm the diagnosis, and provide information to help in the assessment of severity of the condition.

It is important that as part of the diagnosis, an assessment is formed as to the degree of functional limitation that the individual experiences. Early intervention is associated with more successful outcomes where non-interventional therapies are undertaken (for example medication. Evidence also suggests that interventional therapies in terms of joint replacement once disability or inability to undertake normal activities is less successful (NCCCC, 2008). It is important to note that there is little or no correlation between the degree of functional limitation experienced by an individual and radiographic evidence of the progression of osteoarthritis.

### 4.2 Clinical Features

Osteoarthritis is uncommon in individuals aged less than 40. Usually, only one or two joints are affected at one time. Commonly affected joints include the hip, knee and small bones of the hand; less commonly affected joints include the spin, neck, shoulder, elbow, wrist or ankle joints.

Signs and symptoms of osteoarthritis in joints arise slowly and relate more to joint damage rather than inflammation. Pain is the first symptom many individuals report. Common signs and symptoms include:

- Joint pain, particularly after weight bearing activity
- Joint stiffness following periods of inactivity (such as a long period of sitting, or at waking). This usually resolves after short period (around 30 minutes).
- Joint inflammation, joint tenderness
- Restriction in the range of joint movement and/or function
- Crepitus (a crackle or grating feeling which occurs when the joint is moved)
- Joint deformity or bony nodules
- Muscle wasting and/or weakness due to limitation of function (i.e. secondary to the osteoarthritis)
- Possibly warmth on the joint, though this is not common as the condition is

not inflammatory

Clinical features of the most common sites of osteoarthritis are detailed below:

#### 4.2.1 Clinical Features of Osteoarthritis of the Hand

Individuals with osteoarthritis of the hand typically report swelling, pain and stiffness in one of three sites:

- The base of the thumb (i.e. the first carpometacarpal [CMC] joint).
- The joint closest to the finger tip (i.e. the distal interphalangeal [DIP] joint).
- The middle joint of the finger (i.e. the proximal interphalangeal [PIP] joint).

The condition is more common in women than in men.

Heberden's nodes (closest to the finger tip) or Bouchard's nodes (closest to the middle finger joint) may develop. These are bony nodules which develop at the site of mucus filled cysts which form adjacent to the joint on the back of the finger. These nodules are characteristic of osteoarthritis of the hand. There may also be evidence of muscle wasting

(O'Reilly and Doherty, 2003)

#### 4.2.2 Clinical Features of Osteoarthritis of the Hip

Common features include stiffness and restriction of movement. Pain is usually felt deep in the anterior groin but may be felt over a wide area from the lateral and anterior thigh area down as far as the ankle. Pain is often felt in the knee, but is poorly localised, unlike pain arising from osteoarthritis of the knee itself which is much more focussed.

Pain can result in a change of gait which is noticeable on observation. This is due to the individual attempting to spend less time weight bearing on the affected side of the body. (Antalgic Gait)

Advanced hip osteoarthritis leads to a fixed flexion external rotation deformity, with compensatory increased lumbar lordosis and pelvic tilt. The lower limb can be significantly shortened. This results in a characteristic Rolling Gait.

Functional impairment can range from difficulty reaching feet (for example to put on shoes and socks) to limitations in movement such as getting in and out of a car, and limitations in the ability to walk or duration that an individual is able to walk.

(O'Reilly and Doherty, 2003)

#### 4.2.3 Clinical Features of Osteoarthritis of the Knee

Osteoarthritis of the knee usually affects both knees at the same time, in the same location, unless predisposing trauma or disease is involved. Unlike referred pain

from osteoarthritis of the hip, pain is localised to the affected compartment of the knee. This is usually felt during walking, and is felt as either anteromedial pain (from the medial tibiofemoral joint) or anterolateral pain from the lateral tibiofemoral: anterolateral joint.

Individuals may complain of stiffness or 'gelling' after rest, but may also report their knee 'giving way'. This is due to altered load bearing mechanisms and localised muscle weakness. 'Locking' which prevents the knee from being strengthened is also a commonly reported symptom. This is characteristic of osteoarthritis of the knee, and results from loose cartilage in the joint itself.

The range of movement in terms of flexion and extension is often limited. Crepitus may be felt. Wasting of the Quadriceps muscle will be present where significant arthritis is present.

As with osteoarthritis of the hip, an altered gait (Antagic) may develop due to differing load balancing attempts to compensate for the pain.

(O'Reilly and Doherty, 2003; Felson, 2006)

## 4.3 Other History

### 4.3.1 Joint Pain

The cause of pain from osteoarthritis is not clear, as hyaline cartilage does not contain nerve fibres. It is thought that pain may result from stretched joint capsules, inflammation of surrounding soft tissue, muscle spasm, or increased pressure within juxta-articular bone (Doherty, Jones and Cawston, 2004).

Pain can be a transient feature of osteoarthritis and may be absent in spite of severe joint damage (Lawrence, 1977).

The pain is related to activity, is characteristically worse on loading and begins within seconds or minutes of onset of use. It can continue for many hours after the activity has ceased. The description varies with the patient and ranges from a constant ache to discrete stabbing pains. Pain is often associated with tenderness around the joint margin and associated soft tissues. It may be referred to a different site (e.g. osteoarthritis of the hip is commonly felt in the groin or in the knee).

### 4.3.2 Stiffness

This tends to occur imperceptibly often causing patients to subconsciously restrict their activities without being aware of either the stiffness or the alteration in their activities. The reduced range of movement is due to the formation of osteophytes, which stretch the joint capsule or directly impinge on each other.

Joint stiffness causes difficulty with initiating movement and problems with the range of movement. It is often used to describe ache or pain.

Characteristically joints affected by osteoarthritis 'gel' after inactivity.

The short lasting morning stiffness (<30 minutes) is in contrast to that of Rheumatoid Arthritis.

### 4.3.3 Deformity

In more advanced stages of osteoarthritis, periarticular bone becomes enlarged due to osteophyte formation. Joints are swollen with effusion, and may become malaligned. This is caused by asymmetric osteophyte formation and capsular stretching, and direct bone erosion.

## 4.4 Physical Examination

The physical examination may not detect any abnormalities in early stages of the disease. The joint should be examined and any deformities noted as above. An assessment of location of the individual's pain should be made, whether the pain is localised to the affected joint or more widespread. Pain may not be felt in the affected region; in hip joints affected by osteoarthritis the individual may report pain in the groin region, or in the knee.

## 4.5 Investigations

### 4.5.1 Radiological imaging

A working diagnosis of osteoarthritis can usually be reached without radiological imaging, however; these may be required to exclude other possible diagnoses. If structural changes are seen on radiological imaging, it should be noted that these often do not correlate to the clinical symptoms and level of functional disability which is experienced by an individual.

Typical features which may be seen include the loss of joint space, the development of osteophytes and the presence of subchondral bone thickening and/or cysts.

The Kellgren-Lawrence scale is commonly used to classify the severity of osteoarthritis noted on radiological imaging, and is shown in the table below.

Kellgren-Lawrence scale	Grade Comments
0	0 No radiographic findings of osteoarthritis
1	1 Minute osteophytes of doubtful clinical significance
2	2 Definite osteophytes with unimpaired joint space
3	3 Definite osteophytes with moderate joint space narrowing
4	4 Definite osteophytes with severe joint space narrowing and subchondral sclerosis

#### 4.5.2 Magnetic Resonance Imaging

This use of this form of imaging is still developing with respect to osteoarthritis (Doherty et al, 2004). Although there is evidence that specialist forms of MRI may be used to diagnose early stages of osteoarthritis before joint damage occurs (BMJ Best Practice, 2009), there is also evidence that in many cases, MRI images do not reveal any information that would not be found using plain film x-rays (Doherty et al, 2004).

MRI may be used to confirm or exclude alternate diagnoses such as avascular necrosis (AVN) or Internal derangements, for example, meniscal tears.

#### 4.5.3 Laboratory investigations

Laboratory investigations are usually only used to exclude or identify associated disease. Unless there is a coexisting inflammatory process, there is no elevation in ESR, plasma viscosity, or CRP, and Rheumatoid Factor is within normal limits.

The identification of biological markers for disease activity in osteoarthritis has proved complex (unlike Paget's disease) and currently several markers including hyalurononate and cartilage oligomeric complex protein are the most promising candidates.

#### 4.5.4 Other Assessments

Individuals who have chronic conditions, especially those which result in chronic pain or functional limitation, have a higher rate of depression and anxiety than the general population. In addition, individuals who have a degree of functional limitation may find their ability to participate in occupational, social or leisure activities is limited which may contribute to feelings of isolation. It is important therefore that the assessment and management of osteoarthritis takes into account these psychosocial elements, and a full **psychosocial assessment** may be appropriate.

A **falls assessment** may be appropriate for individuals who have reduced mobility due to their osteoarthritis.

## 5. Differential Diagnosis

---

### 5.1 Differential Diagnosis

There are a number of conditions which should be considered as alternative diagnoses to osteoarthritis. These include:

#### 5.1.1 Inflammatory arthritis

Unless very advanced, osteoarthritis does not cause pain or stiffness during periods of sleep or at rest. Other forms of arthritis should be suspected if morning stiffness lasts more than 30 minutes, or causes an individual to awaken at night due to pain.

Stiffness and pain which are relieved by activity rather than rest are also factors which could suggest an alternate form of arthritis.

Inflammatory arthritis may also be suspected if pain or stiffness is reported in the metacarpophalangeal (MCP) joints, wrist, elbow, or ankle,

Forms of inflammatory arthritis include:

- Rheumatoid arthritis.
- Psoriatic arthritis.
- Ankylosing spondylitis.
- Gout.
- Pseudogout (pyrophosphate arthropathy) — may coexist with osteoarthritis.
- Reactive arthritis.
- Arthritis associated with connective tissue disorders such as systemic lupus erythematosus.

(NHS Institute for Innovation and Improvement, 2009)

#### 5.1.2 Other Generalised Differential Diagnoses

These include:

- Fibromyalgia.
- Septic arthritis.
- Fracture of the bone adjacent to the joint.
- Major ligament us injury (recent and old injuries).

- Bursitis.
- Cancer.

### 5.1.3 Differential Diagnoses for Osteoarthritis of the Hand

- De Quervain's tenosynovitis
- Ganglion
- Other hand arthritis
- Osteoarthritis of the metacarpophalangeal joints is rare – this may be rheumatoid arthritis, gout or haemochromatosis

(Doherty et al, 2004)

### 5.1.4 Differential Diagnoses for Osteoarthritis of the Hip

- Inflammatory arthritis
- Trochanteric bursitis
- Entrapment of the lateral femoral cutaneous nerve
- Lumbar radiculopathy
- Lumbar spinal stenosis
- Osteonecrosis:
- Iliotibial band syndrome with symptoms related to the hip.
- Metastatic cancer of the femur,

(Lane, 2007)

### 5.1.5 Differential Diagnoses for Osteoarthritis of the Knee

Exclude pain originating in the hip and referred to the knee, which may be suspected if there is pain on hip rotation or groin tenderness.

Conditions other than inflammatory arthritis that should be specifically distinguished from osteoarthritis of the knee include:

- Chondromalacia patellae
- Anserine bursitis
- Trochanteric bursitis

- Iliotibial band syndrome with symptoms related to the knee
- Joint tumour
- Meniscal tear
- Anterior cruciate ligament tear

**(Felson, 2006)**

## 5.2 Comorbidity

As osteoarthritis is more common with progressing age, it is more likely that an individual will have other comorbid conditions as well as their osteoarthritis. There are a number of factors which should be considered in this respect:

- Comorbid conditions may include diabetic disease, cardiovascular disease, peptic ulcer disease, renal disease, liver disease
- Multiple conditions may mean multiple prescribers are involved in providing medication to treat several conditions. There may be interactions between medication which is routinely prescribed for osteoarthritis and medication that an individual is taking for comorbid conditions (for example non-steroidal anti-inflammatory drugs may be contraindicated)
- Conditions such as heart failure, liver disease etc may affect the choice of prescribing
- An individual's ability to adhere to lifestyle recommendations may be compromised by a comorbid condition. For example, an individual with Chronic Obstructive Pulmonary Disease may find achieving an adequate exercise level to lose weight effectively is difficult.
- Other conditions may affect an individual's mobility
- If joint surgery is indicated, this may be affected by comorbid conditions such as obesity
- Disability has been shown to be greater in individuals with two or more comorbidities in addition to their osteoarthritis (NCCCC, 2008).
- Quality of sleep may be affected by other conditions; as may general mood and wellbeing. Anxiety and depression are more prevalent in individuals with a functional disability.

## 6. Treatment

---

### 6.1 Treatment Options for Osteoarthritis

The treatment options for osteoarthritis depend on an assessment of the severity of pain and the effect that the condition is having on their functional abilities and general quality of life (NCCCC, 2008).

In many cases, co-existing conditions may need to be managed alongside the individual's osteoarthritis, meaning treatment will need to be individualised dependent on their other conditions (for example, the use of NSAIDs avoided if an individual is taking anticoagulation therapies).

Treatment for osteoarthritis will also vary dependent on the affected joint, but is generally aimed at reducing pain, improving/maintaining joint mobility and limiting functional disability. The point at which surgical interventions may be considered also varies dependent on site of the osteoarthritis.

The mainstay of treatment for osteoarthritis has been the use of analgesics, and then surgical intervention when this becomes appropriate. However, there is evidence that non-surgical methods of treatment in conjunction with modification of lifestyle factors can be extremely effective (Hunter, 2009).

#### 6.1.1 Treatment Goals

The treatment goals for osteoarthritis are:

- To control pain
- To reduce stiffness
- To reduce functional limitation

### 6.2 Non-Pharmacological Therapies

Non-Pharmacological therapies which are of benefit in the treatment of osteoporosis are largely those directed towards the modification of lifestyle factors such as the reduction in obesity and the increase in physical exercise.

#### 6.2.1 Patient Education

As with many long term conditions, patient education and advice are considered a mainstay in the management of the condition. There is some evidence in osteoarthritis that patient education and/or the provision of a self-management plan do not significantly alter patient outcomes, however, provision of patient education is still considered to be a cost effective intervention for individuals with osteoarthritis (NCCCC, 2008).

This includes the provision of patient education in groups, for example group physical exercise programmes.

### 6.2.2 Weight Loss

Although studies have not shown that weight loss specifically has a beneficial effect on the progression of osteoarthritis, there is evidence that weight loss in overweight or obese individuals improves their functional ability, and some evidence to state that symptoms of pain are reduced by appropriate weight loss (Messier et al., 2004; NCCCC, 2008).

As there is evidence that osteoarthritis can be caused by mechanical factors including load (NCCCC, 2008), and the prevalence of osteoarthritis is rising in conjunction with the prevalence of obesity, it would appear logical that a reduction in an individual's weight where appropriate would be beneficial to their condition, as well as to their overall health status.

In clinical trials, the reduction in pain and increase in function was far greater in individuals who undertook a combined diet and exercise programme to loose weight, than those who undertook either a dietary programme or exercise (Messier et al, 2004).

### 6.2.3 Exercise Programmes and Physical Therapy

Exercise has been shown to reduce pain and increase function (Minor, 1999; Fransen et al. 2002). Individuals may need convincing that controlled and targeted exercise is an effective form of therapy, however, as many individuals incorrectly believe that any form of exercise will exacerbate their condition, especially if they find that rest eases their symptoms of pain. Most individuals will not have any increase in their symptoms if undertaking controlled exercise (Hurley et al. 2007).

Exercise may comprise of:

- Physical therapy techniques such as manipulation, passive or assisted movement techniques and mobilisation
- Self-help exercise routines either specifically designed for osteoarthritis suffers, or generalised low impact aerobics such as walking, biking, swimming or aqua-exercise programmes (Hunter, 2009)
- Supported programmes of exercise (e.g. aqua-aerobics) specifically designed for osteoarthritis suffers.

### 6.2.4 Footwear, Bracing and Walking Aids

There is evidence to suggest that aids such as braces, walking aids and footwear supports which alter joint mechanics can provide relief from the symptoms of osteoarthritis, and possibly decrease disease progression (Hunter, 2009).

Appropriate Education may be required to support the use of such aids. For example, it is common for individuals to purchase a walking cane, but this is often

incorrectly used and of the incorrect height for the individual. A cane or walking aid should be used on the side opposite to the affected joint, not alongside (Neumann, 1989).

Heel lifts have been shown to provide dramatic pain relief for individuals with osteoarthritis of the hip (Ohsawa and Ueno, 1997).

### 6.2.5 Acupuncture

There is some evidence to state that acupuncture can be effective in the treatment of osteoarthritis, and may provide short to medium term relief from symptoms (NCCCC, 2008). However, this form of therapy is expensive, and may not therefore be cost effective.

## 6.3 Pharmacological Therapies

Further information on the management of chronic pain may be found in the *Chronic Pain and Fibromyalgia* protocol.

### 6.3.1 Analgesia

Analgesic treatment for osteoarthritis comprises of a number of different forms:

- Topical nonsteroidal anti-inflammatory drugs (NSAIDs)
- Topical capsaicin – there is some evidence to indicate this can be beneficial particularly in osteoarthritis of the knee. The NICE guidelines (NCCCC, 2008) suggest this should be used as an additional treatment option for individuals with osteoarthritis of the knee or hand, but comment that evidence supporting the use of this preparation is limited.
- Paracetamol – taken either as needed, or more effectively as regular dosing. Evidence suggests that paracetamol is relatively effective for short term pain relief, but is less effective in reducing pain from osteoarthritis than NSAIDs, especially in individuals with moderate or severe pain (NCCCC, 2008).
- Oral non-steroidal anti-inflammatory drugs – these should be used at the lowest effective dose in order to minimise side effects, and it is recommended that a proton pump inhibitor (PPI) should be co-prescribed to provide gastro-protection (NCCCC, 2008).
- Opioids – Codeine should be considered as the first line opioid therapy if stronger forms of analgesia are required than paracetamol or NSAIDs. Codeine can be prescribed either alone, or in preparations containing paracetamol. Stronger forms of opioid therapy such as fentanyl, buprenorphine patches or morphine should only be prescribed on specialist advice.
- Intra-articular corticosteroids – evidence suggests that intra-articular corticosteroid injections can be beneficial in reducing pain and increasing

mobility in individuals with osteoarthritis of the knee; however there is no evidence to support the use of this therapy in osteoarthritis in other joints (NCCCC, 2008).

### 6.3.2 Glucosamine Sulphate

The National Institute for Health and Clinical Excellence (NICE) review concluded that glucosamine hydrochloride (a licensed preparation in the UK) did not have adequate evidence of effectiveness, and that Glucosamine sulphate (not licensed for use in the UK), has some evidence as to the efficacy, but not enough evidence to support the routine use of this preparation on cost effectiveness grounds.

The NICE recommendation as to self-prescribed use is to use glucosamine sulphate 1500 mg once daily (a divided dose appears to be less effective). Individuals may not find his therapy particularly effective, or receive no benefit from taking glucosamine, so should try the therapy over a 3 month period and discontinue use if it is not effective.

(NCCCC, 2008)

## 6.4 Surgical Interventions

Surgical interventions in the form of total joint replacements are most commonly performed on the hip, knee, and base of thumb joints, but can also be used to shoulder, elbow, wrist, ankle (which can also be fused), metacarpophalangeal, and proximal interphalangeal joints.

Referral for this form of surgery should be made if an individual does not have a satisfactory response to non-surgical treatment. Outcomes are improved if surgical intervention of this kind takes place before any significant symptoms of pain, stiffness or functional limitation have a substantial disabling impact.

Arthroscopic lavage and debridement should only be undertaken in individuals who report problems of mechanical locking of the knee joint. X-ray evidence of 'loose' material or a reported history of a knee gelling or 'giving way' are not considered to be indications for arthroscopic treatment.

It should be noted that referral for surgical assessment should not be restricted by the presence of co-morbidities, increased age or increased body mass index.

The use of scoring systems and questionnaire-based assessments to indicate candidates for surgical intervention is not recommended as these are considered to be inaccurate in their predictions.

(NCCCC, 2009)

### 6.4.1 Joint Replacement

Joint replacement surgery is one of the most effective surgeries available, with the surgery carrying only minor risks, few contraindications, and the benefits

outweighing the disadvantages of continuing conservative treatment (NCCCC, 2009). Hip and Knee replacements are two of the most commonly performed surgeries worldwide (Sibanda et al, 2008). Post-operatively, patients are mobilised early, recover quickly and can expect to resume normal activities within 6-12 weeks of surgery.

There are a large number of different prosthetic devices available, accompanied by a range of techniques for completing the replacement. In general, hip and knee replacement surgeries fall into a number of broad categories dependent on their method of fixation:

- Hip
  - Cemented - most common, >50% replacements are of this type. Lowest revision rate.
  - Cementless
  - Hybrid - one cemented component, one cementless
  - Resurfacing – this procedure conserves femoral bone by replacing only the surface of the joint. Some studies suggest this procedure has high success rates only in specialist centres and in specific patient groups. Revision surgery is not as invasive as with other types of hip replacement, but is higher than with other types of surgery, especially in women.
- Knee
  - Cemented - most common, >85% replacements are of this type. Lowest revision rate.
  - Cementless
  - Hybrid - one cemented component, one cementless
  - Unicondylar – replaces only the damaged knee component. Minimally invasive surgery. Often considered for individuals who are expected to exceed the average life of the prosthesis. However, there is a high revision rate within 3 years, and some evidence to state that patients are less likely to be satisfied following surgery with this particular type of device.
  - Patello-femoral

It is expected that 95% of knee and hip replacements will function effectively until at least the second decade post surgery, with the vast majority functioning effectively and pain free for the remainder of the patient's life. A small percentage of individuals who have had joint replacement therapy do not find the replacement completely effective, but only a very small minority report no benefit at all in terms of pain relief from the replacement (NCCCC, 2009).

Evidence from the National Joint Registry for England and Wales suggests that hip and knee replacements have an overall revision rate of 1.4% (1 in 75 individuals) although the most common types of revision (cemented) are associated with lower rates. The revision risk is twice as high for individuals who have had a replacement for reasons other than osteoarthritis.

(Sibanda et al, 2008)

## 7. Prognosis (Main Prognostic Factors)

---

### 7.1 Overview

There is a wide variation in the development, presentation and progression of osteoarthritis in individuals. Similarly the prognosis and outcome of the condition also varies according to not only the site of the disease (e.g. hand, knee, hip), but also in its affect on the individual concerned with respect to the degree of functional limitation.

It should be noted that osteoarthritis should not be considered as a slowly progressive disease which will lead to increasing pain and functional disability (NCCCC, 2008). There are a number of effective treatment options available which can be accompanied by reduction in modifiable risk factors such as a reduction in an individuals weight (Hunter, 2009).

Different sites of osteoarthritis have differing outcomes.

#### 7.1.1 Osteoarthritis of the Small Bones of the Hand

This condition has a good prognosis. Although an individual may be left with swelling around the distal or proximal interphalangeal joints (Heberden's or Bouchard's nodes), most cases of interphalangeal joint osteoarthritis will become asymptomatic over a period of time (NCCCC, 2008).

#### 7.1.2 Osteoarthritis of the Hip

This condition tends to have a poorer prognosis. Joint replacement provides good long-term pain relief for most patients, and is likely that many individuals with osteoarthritis of the hip will require this surgery within 5 years of diagnosis (NCCCC, 2008).

#### 7.1.3 Osteoarthritis of the Knee

Outcomes of osteoarthritis in this site are very variable, with estimates of one third improving, one third experiencing deterioration in their symptoms and one third having neither an improvement nor deterioration (NCCCC, 2008). Joint replacement is common and successful.

## 8. Information Gathering at the In Person Assessment

---

Most patients present with pain/stiffness and joint abnormalities which on direct questioning are found to impair their ability to perform the normal activities of daily living to varying degrees.

Pain and reduced function are the cardinal symptoms in osteoarthritis and represent the subjective and behavioural consequences of the disease. Anxiety, coping style and possibly depression are associated with the pain and observed disability in osteoarthritis (Dekker et al, 1992).

The bone deformity and mal-alignment of joints limits function with reduced range of movement and pain at the extremes of movement. This is particularly noticeable in joints of locomotion.

Functional limitation causes secondary muscle weakness and wasting thereby further exacerbating instability in severe cases.

Pathological joint changes may have an effect on physical function that is independent of symptoms. Currently little is known about the relationship between these variables and the resultant apparent disability. It is therefore dangerous to conclude that pain alone correlates with disability.

Pain is the most common symptom in the hip and knee particularly while walking and negotiating stairs and less often while sitting and lying.

Pain while at rest is an indication of more severe disease and is usually preceded by a history of pain when joints are active.

Many individuals demonstrate poor correlation between objective clinical findings (examination and X-rays) and functional performance; although in general greater degrees of impairment are associated with the progression of osteoarthritis in any particular joint (Hockberg, 1989).

Other major predictors for disability need to be considered including, poor general health, muscle weakness and atrophy, psychological problems, occupational demands and multiple joint involvement particularly in the lower limbs

Performance based methods of evaluating physical function in patients with chronic diseases such as osteoarthritis have been in existence since the 1980s [24]. However these early methods of assessment had questionable validity and reliability.

Recently more sophisticated 'multidimensional' methods of assessing functional limitations have been developed which, in addition to assessing difficulties in performing 'Activities of Daily Living' (ADLs) now allow the evaluation of social and psychological function.

In the arthritis literature there are several well accepted measures of functional limitation including, indices for assessing the severity of hip (ISH) and knee (ISK) disease (Bellamy, 1998) and the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) (Lesquesne, 1987).

## 9. Analysis of Effect on Functional Ability

---

Eligibility to the Department of Social and Family Affairs various Illness-related schemes and the Activation Programme is determined primarily by the degree of Ability/Disability and its expected duration.

The degree of Ability/Disability assessed, using the following Indicators, can be depicted on the Ability/Disability Profile illustrated below.

### 9.1 Indicators of Ability/Disability

#### Normal

- Occasional use of Paracetamol
- No hospital referral
- No aids
- No nocturnal pain, morning stiffness or pain
- Can stand for 30 mins. Without pain
- No pain on walking unlimited distances
- Can sit for two hours without pain
- No abnormality on observation.
- Walks at normal pace
- Clinical findings normal, can squat easily

#### Mild

- Occasional use of Paracetamol
- No hospital referral
- No aids
- No nocturnal pain, morning stiffness intermittently lasting less than 15 minutes
- Can stand for 30 minutes without pain
- Intermittent pain on walking unlimited distances particularly over uneven surfaces
- Can sit for two hours without pain

- No difficulty with stairs
- No abnormality on observation
- Walks at normal pace
- Can remove and replace socks without real difficulty
- Can pick up an object from the floor easily
- Clinical findings normal, can squat easily

### **Moderate**

- May be on regular Paracetamol and an anti-inflammatory preparation
- May have history of previous hospital referral resulting in discharge with no follow up
- No aids required
- No nocturnal pain
- Some morning stiffness but lasts less than 15 minutes
- Standing 30 mins. sometimes increases pain
- Pain on walking only over significant distances on level ground (500-900m)
- Some pain on sitting two hours or more
- Some difficulty going up and down a flight of stairs
- May walk at a normal pace with a slight limp or if hands involved may show some difficulty with fine movement
- Moderate difficulty removing socks and picking up an object from the floor
- Clinical findings are likely to be normal in lower limbs
- May show evidence of Heberden,s, Boucheron,s nodes in hands

### **Severe**

- On maximum medication
- May require use of stick or crutch
- Under review at Orthopaedic clinic and surgery proposed if no contraindications
- Nocturnal pain on movement or in certain positions

- Morning stiffness lasts more than 15 mins.
- Pain after standing 30 mins
- Pain on walking early after starting (300-500m)
- Pain after sitting 30 mins.
- Marked difficulty on stairs
- Abnormal gait
- Slow pace
- Removes and replaces socks with marked difficulty
- Can retrieve an object from the floor with marked difficulty
- Joint abnormality and deformity on examination
- Evidence of muscle wasting
- Reduced range of joint movement

### **Profound**

- On maximum medication
- Awaiting joint replacement (if not contraindicated) or awaiting revision surgery due to aging prosthesis or previously unsuccessful joint replacement surgery
- Stick or crutches required
- Nocturnal pain without movement
- Morning stiffness lasts more than 15 minutes
- Cannot stand for 30 minutes
- Pain on walking 100-300m
- Cannot sit for 30 minutes without pain
- Cannot go up and down a standard set of stairs
- Abnormal gait
- Slow pace
- Cannot remove or replace socks
- Cannot retrieve an object from the floor

- Joint abnormality and deformity on examination
- Muscle wasting
- Reduced joint movement

## 9.2 Ability/Disability Profile

10. Indicate the degree to which the claimant's condition has affected their ability in ALL of the following areas.					
	Normal	Mild	Moderate	Severe	Profound
Mental health/Behaviour	<input type="checkbox"/>				
Learning/Intelligence	<input type="checkbox"/>				
Consciousness/Seizures	<input type="checkbox"/>				
Balance/Co-ordination	<input type="checkbox"/>				
Vision	<input type="checkbox"/>				
Hearing	<input type="checkbox"/>				
Speech	<input type="checkbox"/>				
Continence	<input type="checkbox"/>				
Reaching	<input type="checkbox"/>				
Manual dexterity	<input type="checkbox"/>				
Lifting/Carrying	<input type="checkbox"/>				
Bending/Kneeling/Squatting	<input type="checkbox"/>				
Sitting	<input type="checkbox"/>				
Standing	<input type="checkbox"/>				
Climbing stairs/Ladders	<input type="checkbox"/>				
Walking	<input type="checkbox"/>				

## 10. Summary of Scheme Criteria

---

Scheme eligibility criteria are maintained on the DSP website and are accessible from the following links:

- **Carer's Allowance**  
[http://www.welfare.ie/EN/OperationalGuidelines/Pages/carers\\_all.aspx](http://www.welfare.ie/EN/OperationalGuidelines/Pages/carers_all.aspx)
- **Carer's Benefit**  
[http://www.welfare.ie/EN/OperationalGuidelines/Pages/carers\\_ben.aspx](http://www.welfare.ie/EN/OperationalGuidelines/Pages/carers_ben.aspx)
- **Disability Allowance**  
<http://www.welfare.ie/EN/OperationalGuidelines/Pages/disall.aspx>
- **Disablement Benefit**  
[http://www.welfare.ie/EN/OperationalGuidelines/Pages/oib\\_disableb.aspx](http://www.welfare.ie/EN/OperationalGuidelines/Pages/oib_disableb.aspx)
- **Domiciliary Care Allowance**  
<http://www.welfare.ie/EN/Schemes/IllnessDisabilityAndCaring/Carers/DomiciliaryCareAllowance/Pages/DomiciliaryCareAllowance.aspx>
- **Illness Benefit**  
<http://www.welfare.ie/EN/OperationalGuidelines/Pages/illben.aspx>
- **Injury Benefit**  
[http://www.welfare.ie/EN/OperationalGuidelines/Pages/oib\\_injuryb.aspx](http://www.welfare.ie/EN/OperationalGuidelines/Pages/oib_injuryb.aspx)
- **Invalidity Pension**  
<http://www.welfare.ie/EN/OperationalGuidelines/Pages/invalidity.aspx>
- **Respite Care Grant**  
<http://www.welfare.ie/EN/OperationalGuidelines/Pages/respitegrant.aspx>

## 11. References and Bibliography

---

Arthritis Ireland (2009) 'Facts about Arthritis' accessed at <http://www.arthritisireland.ie/info/facts.php> January 2010

Bellamy N, et al. (1988) 'Validation study of WOMAC' J Rheum 1988; 15:1833 – 1840

Bhalla AK, Wojno WC, Goldring MB. (1987) 'Human articular chondrocytes acquire 1,25-(OH)<sub>2</sub> vitamin D<sub>3</sub> receptors in culture' in Biochim Biophys Acta. 1987;931:26 – 32 (Bhalla et al, 1987; McAlindon et al , 1996)

BMJ Best Practice (2009) 'Osteoarthritis' accessed at <http://bestpractice.bmj.com/best-practice/monograph/192/basics/epidemiology.html> January 2010

Badley E, DesMeules M. (2003) 'Arthritis in Canada: An Ongoing Challenge' 2003. Ottawa, Canada as cited by Hunter D. (2007) 'In the Clinic:Osteoarthritis' Annals of Internal Medicine 147:ITC8-2

CDC - Centers for Disease Control and Prevention (1994) 'Arthritis prevalence and activity limitations in the US (1990) in MMWR Morb Mortal Wkly Rep. 1994;43:433-8 as cited by Hunter D. (2007) 'In the Clinic:Osteoarthritis' Annals of Internal Medicine 147:ITC8-2

Coggon, D., Reading, I., Croft, P., McLaren, M., Barrett, D., Cooper, C. et al. (2001) Knee osteoarthritis and obesity. Int J Obes Relat Metab Disord 25: 622:627 as cited by Hunter D. (2009) 'Focusing osteoarthritis management on modifiable risk factors and future therapeutic prospects' Ther Adv Musculoskel Dis 1(1) 35:47 full text accessed at <http://tab.sagepub.com/cgi/reprint/1/1/35> accessed January 2010

Dawson, J Fitzpatrick, R., Fletcher, K. Wilson, R. (2004) 'Osteoarthritis Affecting the Hip and Knee', in A Stevens, J Raftery, J Mant and S Simpson (eds.), Health Care Needs Assessment. Oxford: Radcliffe Publishing, 2004, pp 549-634

Dekker J, et al. (1992) 'Pain and disability in osteoarthritis. A review of behavioural mechanisms' in J Behav Med. 1992; 15(2):189 – 214

Doherty M, Jones, A. Cawston, T. (2004) 'Osteoarthritis' in Maddison, P. Isenberg, D. Woo, P and Glass, D. (Eds.) 'Oxford textbook of Rheumatology' Oxford University Press: Oxford

Eyre DR. (2004) 'Collagens and cartilage matrix homeostasis' in Clin Orthop Relat Res. 2004:S118-22.

Felson D. (1994) 'Do occupation related physical factors contribute to arthritis?' Balliers Clin Rheumatol. 1994; 8(1): 63-77

Felson D. et al, (2000) 'Osteoarthritis: New Insights. Part 1: The Disease and Its Risk Factors' Ann. Intern. Med. 2000;133:635 – 646

Felson, D. (2006) Clinical practice. Osteoarthritis of the knee. New England Journal of Medicine 354(8), 841-848.

Fransen M, McConnell S, Bell M (2002) Therapeutic exercise for people with osteoarthritis of the hip or knee. A systematic review. Journal of Rheumatology 29 (8): 1737–45. as cited NCCCC - National Collaborating Centre for Chronic Conditions. Osteoarthritis: national clinical guideline for care and management in adults. London: Royal College of Physicians, 2008 accessed at [www.nice.org](http://www.nice.org) January 2010

Guccione, A.A., Felson, D.T., Anderson, J.J., Anthony, J.M., Zhang, Y., Wilson, P.W. et al. (1994) 'The effects of specific medical conditions on the functional limitations of elders in the Framingham Study' Am J Public Health 84: 351:358 as cited by Hunter D. (2009) 'Focusing osteoarthritis management on modifiable risk factors and future therapeutic prospects' Ther Adv Musculoskel Dis 1(1) 35:47 full text accessed at <http://tab.sagepub.com/cgi/reprint/1/1/35> accessed January 2010

Hochberg M, et al. (1989) 'Epidemiological associations of pain in osteoarthritis of the knee' Seminars in Arthritis and Rheumatism 1989; 18: 4-9].

Hurley MV, Walsh NE, Mitchell HL et al. (2007) Clinical effectiveness of a rehabilitation program integrating exercise, self-management, and active coping strategies for chronic knee pain: a cluster randomized trial. Arthritis & Rheumatism 57 (7): 1211–9. as cited NCCCC - National Collaborating Centre for Chronic Conditions. Osteoarthritis: national clinical guideline for care and management in adults. London: Royal College of Physicians, 2008 accessed at [www.nice.org](http://www.nice.org) January 2010

Hunter D. (2007) 'In the Clinic:Osteoarthritis' Annals of Internal Medicine 47:ITC8-2

Hunter D. (2009) 'Focusing osteoarthritis management on modifiable risk factors and future therapeutic prospects' Ther Adv Musculoskel Dis 1(1) 35:47 full text accessed at <http://tab.sagepub.com/cgi/reprint/1/1/35> accessed January 2010

Hunter D and Felson D. (2006) 'Osteoarthritis' BMJ. 2006;332:639-642.

Hunter, D.J., Patil, V., Niu, J.B., McLennan, C., LaValley, M., Genant, H. et al. (2004) The etiology of knee pain in the community. Arthritis Rheum 50: 1885.

Industrial Injuries Advisory Council on behalf of the Department of Work and Pensions (DWP) (2008) 'Osteoarthritis of the knee in coal miners' Command Paper 77401 The Stationary Office: London

Kokebie R and Block JA ().(2008) "[Managing osteoarthritis: Current and future directions](http://jmm.consultantlive.com/display/article/1145622/1404662)". Journal of Musculoskeletal Medicine. <http://jmm.consultantlive.com/display/article/1145622/1404662>.

Lane, N.E. (2007) Clinical practice. Osteoarthritis of the hip. New England Journal of Medicine 357(14), 1413-1421.

Lawrence J. (1977) 'Rheumatism in populations' Heinemann, London

Lawrence R et al. Estimates of the prevalence of selected arthritic and musculoskeletal diseases in the United States *J Rheum* 1989; 16: 427-41

Lequesne MG, Dang N, Lane N. (1977) 'Sport practice and osteoarthritis of the limbs' in *Osteoarthritis and cartilage* 1977; 5: 75-86

Lesquesne MG, et al. (1987) 'Indices of severity of the hip and knee' in *Scand J Rheumatol.* 1987;65(suppl): 58 – 59

Lievensse A, Bierma-Zeinstra S, Verhagen A, et al. (2001) 'Influence of work on the development of osteoarthritis of the hip: a systematic review' *J Rheumatol* 2001;28:2520–2528

Lievensse AM, Bierma-Zeinstra SM, Verhagen AP, et al. (2003) 'Influence of sporting activities on the development of osteoarthritis of the hip: a systematic review' *Arthritis Care Res* 2003;49:228–236.

McAlindon TE, Jacques P, Zhang Y, Hannan MT, Aliabadi P, Weissman B, et al. (1996) 'Do antioxidant micronutrients protect against the development and progression of knee osteoarthritis?' in *Arthritis Rheum.* 1996;39:648 – 656

Messier, S.P., Loeser, R.F., Miller, G.D., Morgan, T.M., Rejeski, W.J., Sevick, M.A. et al. (2004) Exercise and dietary weight loss in overweight and obese older adults with knee osteoarthritis: the Arthritis, Diet, and Activity Promotion Trial. *Arthritis Rheum* 50: 1501:1510 as cited by Hunter D. (2009) 'Focusing osteoarthritis management on modifiable risk factors and future therapeutic prospects' *Ther Adv Musculoskel Dis* 1(1) 35:47 full text accessed at <http://tab.sagepub.com/cgi/reprint/1/1/35> accessed January 2010

Minor MA (1999) Exercise in the treatment of osteoarthritis. *Rheumatic Diseases Clinics of North America* 25 (2): 397–415, viii as cited NCCCC - National Collaborating Centre for Chronic Conditions. Osteoarthritis: national clinical guideline for care and management in adults. London: Royal College of Physicians, 2008 accessed at [www.nice.org](http://www.nice.org) January 2010

NCCCC - National Collaborating Centre for Chronic Conditions. Osteoarthritis: national clinical guideline for care and management in adults. London: Royal College of Physicians, 2008 accessed at [www.nice.org](http://www.nice.org) January 2010

Nevitt MC, Xu L, Zhang Y, et al. (2002) Very low prevalence of hip osteoarthritis among Chinese elderly in Beijing, China, compared with whites in the United States: the Beijing osteoarthritis study. *Arthritis Rheum.* 2002;46:1773-9.

Neumann DA. (1989) Biomechanical analysis of selected principles of hip joint protection. *Arthritis Care Res* 1989; 2: 146–55. as cited in O'Reilly, S. and Doherty, M. (2003) Chapter 8: Signs, symptoms, and laboratory tests. In: Brandt, K., Doherty, M. and Lohmander, S. (Eds.) *Osteoarthritis*. 2nd edn. Oxford: Oxford University Press

NHS Institute for Innovation and Improvement (2008) 'Osteoarthritis' accessed at <http://www.cks.nhs.uk/osteoarthritis#-324227> January 2010

Oben, J. Enonchong, E. Kothari, S. (2009) 'Phellodendron and Citrus extracts benefit joint health in osteoarthritis patients: a pilot, double-blind, placebo-controlled study' *Nutr J.* 2009; 8: 38

Ohsawa S, Ueno R. (1997) Heel lifting as a conservative therapy for osteoarthritis of the hip: based on the rationale of Pauwels' intertrochanteric osteotomy. *Prosthet Orthot Int* 1997; 21: 153–8 as cited in O'Reilly, S. and Doherty, M. (2003) Chapter 8: Signs, symptoms, and laboratory tests. In: Brandt, K., Doherty, M. and Lohmander, S. (Eds.) *Osteoarthritis*. 2nd edn. Oxford: Oxford University Press

O'Reilly, S. and Doherty, M. (2003) Chapter 8: Signs, symptoms, and laboratory tests. In: Brandt, K., Doherty, M. and Lohmander, S. (Eds.) *Osteoarthritis*. 2nd edn. Oxford: Oxford University Press

Reichenbach, S., Guermazi, A., Niu, J., Neogi, T., Hunter, D.J., Roemer, F.W. et al. (2008) Prevalence of bone attrition on knee radiographs and MRI in a community-based cohort. *Osteoarthritis Cartilage* 16: 1005:1010 as cited by . Hunter D. (2009) 'Focusing osteoarthritis management on modifiable risk factors and future therapeutic prospects' *Ther Adv Musculoskel Dis* 1(1) 35:47 full text accessed at <http://tab.sagepub.com/cgi/reprint/1/1/35> accessed January 2010

Sibanda N, Copley LP, Lewsey JD, Borroff M, Gregg P, et al. (2008) Revision Rates after Primary Hip and Knee Replacement in England between 2003 and 2006. *PLoS Med* 5(9): e179 accessed at <http://www.plosmedicine.org/article/info:doi/10.1371/journal.pmed.0050179> January 2010

Scott, D., (2009) 'Osteoarthritis' in *BMJ Clinical Evidence* accessed at [http://clinicalevidence.bmj.com/cweb/conditions/msd/1122/1122\\_background.jsp](http://clinicalevidence.bmj.com/cweb/conditions/msd/1122/1122_background.jsp) January 2010

World Health Organisation (2007) 'International Classification of Diseases (ICD) 10th Edition' World Health Organisation: Geneva