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Hip Pain and Mobility Deficits – Hip Osteoarthritis:

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association

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Recommendations*

PATHOANATOMICAL FEATURES: Clinicians should assess for impairments in mobility of the hip joint and the strength of the surrounding muscles, especially the hip abductor muscles, when a patient presents with hip pain. (Recommendation based on weak evidence.)

RISK FACTORS: Clinicians should consider age, hip developmental disorders, and previous hip joint injury as risk factors for hip osteoarthritis. (Recommendation based on strong evidence.)

DIAGNOSIS/CLASSIFICATION: Moderate lateral or anterior hip pain during weight bearing, in adults over the age of 50 years, with morning stiffness less than 1 hour, with limited hip internal rotation and hip flexion by more than 15° when comparing the painful to the nonpainful side are useful clinical findings to classify a patient with hip pain into the International Statistical Classification of Diseases and Related Health Problems (ICD) category of unilateral coxarthrosis and the associated International Classification of Functioning, Disability, and Health (ICF) impairment-based category of hip pain (b2816 Pain in joints) and mobility deficits (b7100 Mobility of a single joint). (Recommendation based on strong evidence.)

DIFFERENTIAL DIAGNOSIS: Clinicians should consider diagnostic classifications other than osteoarthritis of the hip when the patient's history, reported activity limitations, or impairments of body function and structure are not consistent with those presented in the diagnosis/classification section of this guideline, or, when the patient's symptoms are not diminishing with interventions aimed at normalization of the patient's impairments of body function. (Recommendation based on expert opinion.)

EXAMINATION – OUTCOME MEASURES: Clinicians should use validated functional outcome measures, such as the Western Ontario and McMaster Universities Osteoarthritis Index, the Lower Extremity Functional Scale, and the Harris Hip Score before and after interventions intended to alleviate the impairments of body function and structure, activity limitations, and participation restrictions associated with hip osteoarthritis. (Recommendation based on strong evidence.)

EXAMINATION – ACTIVITY LIMITATION AND PARTICIPATION RESTRICTION MEASURES: Clinicians should utilize easily reproducible physical performance measures, such as the 6-minute walk, self-paced walk, stair measure, and timed up-and-go tests to assess activity limitation and participation restrictions associated with their patient's hip pain and to assess the changes in the patient's level of function over the episode of care. (Recommendation based on strong evidence.)

INTERVENTIONS - PATIENT EDUCATION: Clinicians should consider the use of patient education to teach activity modification, exercise, weight reduction when overweight, and methods of unloading the arthritic joints. (Recommendation based on moderate evidence.)

INTERVENTIONS – FUNCTIONAL, GAIT, AND BALANCE TRAINING: Functional, gait, and balance training, including the use of assistive devices such as canes, crutches, and walkers, can be used in patients with hip osteoarthritis to improve function associated with weight-bearing activities. (Recommendation based on weak evidence.)

INTERVENTIONS – MANUAL THERAPY: Clinicians should consider the use of manual therapy procedures to provide short-term pain relief and improve hip mobility and function in patients with mild hip osteoarthritis. (Recommendation based on moderate evidence.)

INTERVENTIONS – FLEXIBILITY, STRENGTHENING, AND ENDURANCE EXERCISES: Clinicians should consider the use of flexibility, strengthening, and endurance exercises in patients with hip osteoarthritis. (Recommendation based on moderate evidence.)

*These recommendations and clinical practice guidelines are based on the scientific literature published prior to September 2008.

Introduction

AIM OF THE GUIDELINE

The Orthopaedic Section of the American Physical Therapy Association (APTA) has an ongoing effort to create evidence-based practice guidelines for orthopaedic physical therapy management of patients with musculoskeletal impairments described in the World Health Organization's International Classification of Functioning, Disability, and Health (ICF).[210]

The purposes of these clinical guidelines are to:

- Describe evidence-based physical therapy practice including diagnosis, prognosis, intervention, and assessment of outcome for musculoskeletal disorders commonly managed by orthopaedic physical therapists
- Classify and define common musculoskeletal conditions using the World Health Organization's terminology related to impairments of body function and body structure, activity limitations, and participation restrictions

Introduction *(continued)*

- Identify interventions supported by current best evidence to address impairments of body function and structure, activity limitations, and participation restrictions associated with common musculoskeletal conditions
- Identify appropriate outcome measures to assess changes resulting from physical therapy interventions in body function and structure as well as in activity and participation of the individual
- Provide a description to policy makers, using internationally accepted terminology, of the practice of orthopaedic physical therapists
- Provide information for payors and claims reviewers regarding the practice of orthopaedic physical therapy for common musculoskeletal conditions
- Create a reference publication for orthopaedic physical therapy clinicians, academic instructors, clinical instructors, students, interns, residents, and fellows regarding the best current practice of orthopaedic physical therapy

STATEMENT OF INTENT

This guideline is not intended to be construed or to serve as a standard of medical care. Standards of care are determined on the basis of all clinical data available for an individual patient and are subject to change as scientific knowledge and technology advance and patterns of care evolve. These parameters of practice should be considered guidelines only. Adherence to them will not ensure a successful outcome in every patient, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgment regarding a particular clinical procedure or treatment plan must be made in light of the clinical data presented by the patient, the diagnostic and treatment options available, and the patient's values, expectations, and preferences. However, we suggest the rationale for significant departures from accepted guidelines be documented in the patient's medical records at the time the relevant clinical decision is made.

Methods

The Orthopaedic Section, APTA appointed content experts as developers and authors of clinical practice guidelines for musculoskeletal conditions of the hip which are commonly treated by physical therapists. These content experts were given the task to identify impairments of body function and structure, activity limitations, and participation restrictions, described using ICF terminology, which could (1) categorize patients into mutually exclusive impairment patterns upon which to base intervention strategies, and (2) serve as measures of changes in function over the course of an episode of care. The second task given to the content experts was to describe the supporting evidence for the identified impairment pattern classification as well as interventions for patients with activity limitations and impairments of body function and structure consistent with the identified impairment pattern classification. It was also acknowledged by the Orthopaedic Section, APTA content experts that a systematic search and review of the evidence solely related to diagnostic categories based on International Statistical Classification of Diseases and Related Health Problems (ICD)[209] terminology would not be useful for these ICF-based clinical practice guidelines as most of the evidence associated with changes in levels of impairment or function in homogeneous populations is not readily searchable using the ICD terminology.

The authors of this guideline (M.T.C., D.M.W., J.W.) independently performed a systematic search of the MEDLINE, CINAHL, and the Cochrane Database of Systematic Reviews (1967 through August 2008) for any relevant articles related to classification, examination, and intervention for musculoskeletal conditions of the hip region commonly treated by physical therapists. As relevant articles were identified, their reference lists were hand-searched in an attempt to identify additional articles that might contribute to the outcome of this guideline. Articles from the searches were compiled by 3 of the authors (M.T.C., D.M.W., J.W.) and this compilation was reviewed for accuracy and completeness by 3 other authors (M.H.H., K.E., T.L.F.). Articles with the highest levels of evidence that were most relevant to classification, examination, and intervention for patients with hip pain, mobility deficits, and osteoarthritis (OA) were included in this guideline.

This guideline was issued in 2009 based upon publications in the scientific literature prior to September 2008. This guideline will be considered for review in 2013, or sooner if new evidence becomes available. Any updates to the guideline in the interim period will be noted on the Orthopaedic Section of the APTA website: www.orthopt.org

Methods *(continued)*

LEVELS OF EVIDENCE

Individual clinical research articles were graded according to criteria described by the Center for Evidence-Based Medicine, Oxford, United Kingdom (Table 1, below).

I	Evidence obtained from high-quality randomized controlled trials, prospective studies, or diagnostic studies
II	Evidence obtained from lesser-quality randomized controlled trials, prospective studies, or diagnostic studies (eg, improper randomization, no blinding, <80% follow-up)
III	Case-controlled studies or retrospective studies
IV	Case series
V	Expert opinion

GRADES OF EVIDENCE

The overall strength of the evidence supporting recommendations made in this guideline were graded according to guidelines described by Guyatt et al,[75] as modified by MacDermid and adopted by the coordinator and reviewers of this project. In this modified system, the typical A, B, C, and D grades of evidence have been modified to include the role of consensus expert opinion and basic science research to demonstrate biological or biomechanical plausibility (Table 2, below).

GRADES OF RECOMMENDATION BASED ON		STRENGTH OF EVIDENCE
A	Strong evidence	A preponderance of level I and/or level II studies support the recommendation. This must include at least 1 level I study
B	Moderate evidence	A single high-quality randomized controlled trial or a preponderance of level II studies support the recommendation
C	Weak evidence	A single level II study or a preponderance of level III and IV studies, including statements of consensus by content experts support the recommendation
D	Conflicting evidence	Higher-quality studies conducted on this topic disagree with respect to their conclusions. The recommendation is based on these conflicting studies
E	Theoretical/ foundational evidence	A preponderance of evidence from animal or cadaver studies, from conceptual models/principles, or from basic sciences/ bench research support this conclusion
F	Expert opinion	Best practice based on the clinical experience of the guidelines development team

REVIEW PROCESS

The Orthopaedic Section, APTA also selected consultants from the following areas to serve as reviewers of the early drafts of this clinical practice guideline:

- Arthritis Foundation
- Claims review
- Coding
- Epidemiology
- Rheumatology
- Section on Geriatrics of the APTA
- Medical practice guidelines
- Orthopaedic physical therapy residency education
- Physical therapy academic education
- Sports physical therapy residency education

Comments from these reviewers were utilized by the authors to edit this clinical practice guideline prior to submitting it for publication to the *Journal of Orthopaedic & Sports Physical Therapy*.

In addition, several physical therapists practicing in orthopaedic and sports physical therapy settings were sent initial drafts of this clinical practice guideline along with feedback forms to determine its usefulness, validity, and impact. All returned feedback forms from these practicing clinicians described this clinical practice guideline as:

- "Moderately useful" or "extremely useful"
- An "accurate representation of the peer-reviewed literature"
- A guideline that will have a "substantial positive impact on orthopaedic physical therapy patient care"

CLASSIFICATION

The primary ICD-10 code and condition associated with hip pain and mobility deficits is M16.1 Primary coxarthrosis, unilateral. In the ICD, the term osteoarthritis (OA) is used as a synonym for arthrosis or osteoarthrosis. Other, secondary codes associated with hip OA are M16.0 Primary coxarthrosis, bilateral; M16.2 Coxarthrosis resulting from dysplasia, bilateral; M16.3 Dysplastic coxarthrosis, unilateral; M16.4 Posttraumatic coxarthrosis, bilateral; M16.5 Posttraumatic coxarthrosis, unilateral; M16.7 Secondary coxarthrosis, not otherwise specified. The corresponding ICD-9 CM codes and conditions, which are used in the USA, are 715.15 Osteoarthrosis of the pelvic region and thigh, localized, primary; 715.25 Osteoarthrosis of the pelvic region and thigh, localized, secondary; 715.85 Osteoarthrosis of the pelvic region and thigh involving more than 1 site but not specified as generalized.

The primary ICF body function codes associated with the above noted primary ICD-10 condition are the sensory functions related to pain and the movement-related functions related to joint mobility. These body function codes are **b2816 Pain in joints** and **b7100 Mobility of a single joint.**

The primary ICF body structure codes associated with hip pain and mobility deficits are **s75001 Hip joint, s7402 Muscles of pelvic region,** and **s7403 Ligaments and fascia of pelvic region.**

The primary ICF activities and participation codes associated with hip pain and mobility deficits are **d4154 Maintaining a standing position, d4500 Walking short distances,** and **d4501 Walking long distances.**

The ICD-10 and primary and secondary ICF codes associated with hip pain and mobility deficits are provided in Table 3 on the facing page.

ICD-10 and ICF Codes Associated With Hip Pain and Mobility Deficits

INTERNATIONAL STATISTICAL CLASSIFICATION OF DISEASES AND RELATED HEALTH PROBLEMS		
Primary ICD-10	M16.1	Primary coxarthrosis, unilateral
Secondary ICD-10	M16.0	Primary coxarthrosis, bilateral
	M16.2	Coxarthrosis resulting from dysplasia, bilateral
	M16.3	Dysplastic coxarthrosis, unilateral
	M16.4	Posttraumatic coxarthrosis, bilateral
	M16.5	Posttraumatic coxarthrosis, unilateral
	M16.7	Secondary coxarthrosis, not otherwise specified

INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY, AND HEALTH		
	PRIMARY ICF CODES	
Body functions	b28016	Pain in joints
	b7100	Mobility of a single joint
Body structure	s75001	Hip joint
	s7402	Muscles of pelvic region
	s7403	Ligaments and fascia of pelvic region
Activities and participation	d4154	Maintaining a standing position
	d4500	Walking short distances
	d4501	Walking long distances
	SECONDARY ICF CODES	
Body functions	b7201	Mobility of the pelvis
	b7300	Power of isolated muscles and muscle groups
	b7401	Endurance of muscle groups
	b770	Gait pattern functions
	b7800	Sensation of muscle stiffness
Body structure	s7401	Joints of pelvic region
Activities and participation	d4101	Squatting
	d4103	Sitting
	d4106	Shifting the body's center of gravity
	d4350	Pushing with lower extremities
	d4351	Kicking
	d4502	Walking on different surfaces
	d4503	Walking around obstacles
	d4551	Climbing
	d4552	Running
	d4553	Jumping
	d4600	Moving around within the home
	d4601	Moving around within buildings other than home
	d4602	Moving around outside the home or other buildings

CLINICAL GUIDELINES

Impairment/Function-based Diagnosis

PREVALENCE

Hip pain associated with OA is the most common cause of hip pain in older adults.[7,40] Prevalence studies have shown the rates for adult hip OA range from 0.4% to 27%.[8,40,74,89,126,211]

PATHOANATOMICAL FEATURES

The proximal femur articulates with the acetabulum to form the hip joint. The femoral head is two thirds of a sphere covered with hyaline cartilage and enclosed in a fibrous capsule.[50,168] The femoral head is connected to the femoral shaft via the femoral neck. In the frontal plane the femoral neck lies at an angle to the shaft of the femur. This "angle of inclination" is normally 120° to 125° in the adult population.[50] In the transverse plane the proximal femur is oriented anterior to the distal femoral condyles as a result of a medial torsion of the femur with a normal range between 14° to 18° of anteversion.[28] The hip joint is a "ball and socket" synovial joint with articular cartilage and a fully developed joint capsule allowing movement in all 3 body planes.[168] The joint capsule attaches around the acetabular rim proximally and distally at the inter-trochanteric line. Three strong ligaments reinforce the joint capsule, the iliofemoral and pubofemoral ligaments anteriorly and ischiofemoral ligament posteriorly.[50]

II In OA of the hip the entire joint structure and function is affected, with joint capsular changes (shortening and lengthening) creating limitation in hip joint range of motion (ROM) along with subsequent articular cartilage degeneration.[120,148] Later in the disease process osteophytes or spurs may develop from excessive tensile force on the hip joint capsule or from abnormal pressure on the articular cartilage.[6,120] Other changes also develop including sclerosis of the subchondral bone from increased focal pressure, and sometimes the formation of cysts.[98] Muscle weakness often develops around a joint with OA,[171] specifically the abductor muscles of the hip.[156] Most significantly, the hip abductor muscles progressively weaken in the later stages of hip OA, which may create a Trendelenberg gait pattern over time.[11] Clinicians must not overlook the function of the hip muscles at different hip positions, for example the gluteus medius is an abductor when at 0° of flexion (standing) but an external rotator at 90° of flexion (sitting).[129]

C Clinicians should assess for impairments in the mobility of the hip joint and the strength of the surrounding muscles, especially the hip abductor muscles, when a patient presents with hip pain.

RISK FACTORS

I *Age* The most common predisposing factor for hip OA is age. The condition primarily affects middle-aged and elderly people, most often those over 60 years.[2,154,177] Tepper and Hochberg[177] found that age was significantly associated with hip OA (adjusted odds ratio of 1.30 (95% CI: 0.60-2.81) for ages 60 to 64 years, 2.38 (95% CI: 0.83-3.44) for ages 65 to 69 years, and 2.38 (95% CI: 1.15-4.92) for ages 70 to 74 years.

I *Developmental Disorders* Many studies have demonstrated a link between developmental disorders, such as Legg-Calve-Perthes disease, congenital hip dislocation, or slipped capital femoral epiphysis, and premature OA of the hip.[1,61,62,91,92,139,214] The majority of the evidence also shows that dysplasia of the femur and the acetabulum is associated with hip OA.[49,52,92,94,162,178,185-188] Dysplasia is defined as any change in orientation of the acetabulum or the proximal femur, which creates a change in how the femur and the acetabulum articulate with each other.[93] Types of dysplasia include coxa vara, coxa valga, femoral anteversion, femoral retroversion, acetabular anteversion, acetabular retroversion, coxa plana, and coxa profundus.[20,92,93] However, a few authors show limited association between hip dysplasia and OA of the hip.[20,90,108,207]

III *Race* Studies of non-Caucasian populations including Asian, African, and East Indian populations indicate a very low prevalence of primary hip OA when compared to that of Caucasians of European ancestry.[81,211] Thus, race likely plays some sort of role in the development of hip OA. This role, however, is unknown at this time.

I *Gender* Few studies have been performed that examine the association between gender and hip OA.[41,97,145,154] Tepper and Hochberg[177] found that males have a slightly greater prevalence of hip OA compared

to females (3.2% compared to 3.0%). Although little if any difference in incidence exists between genders, men and women appear to have different patterns of hip OA. Women have a more superiomedial femoral migration while men have a more superiolateral migration.[44,111] There is strong evidence that superiolateral migration is an important prognostic factor in the progression of hip OA.[15]

II *Genetics* Siblings show a high association of hip OA, suggesting a possible genetic role.[109] While the nature of the genetic influence is still speculative, it has been postulated that hip OA involves either a structural defect (ie, collagen) or alterations in cartilage or bone metabolism.[106,121,122] Genetics is often linked to hip OA because of the low prevalence of hip OA in Asian and African populations in their native countries and the familial association of hip OA in Caucasians.[81] Some studies have shown that genetic factors may play a role in the development of hip OA,[100,106,124] or in reducing the risk of hip OA in women.[113] Although there has been much interest and speculation in looking for a genetic link to hip OA, currently there is insufficient evidence to explain how genetics is related to the development of hip OA.

III *Occupation* Numerous researchers in Europe and the United States have found a higher prevalence of hip OA in male workers whose occupation involved lifting very heavy loads over a prolonged period.[125,201,203,204] Farming, in particular, has been identified as a high-risk occupation for the development of hip OA. However, a specific aspect of farming which leads to the development of hip OA has not been identified. Suspected risk factors have been suggested, including regular heavy lifting, tractor driving (vibration), and walking on uneven ground.[36,84,125,179-182,208] Vibration was specifically studied and reported to not be associated with the development of hip OA.[96] In summary, there is weak evidence linking the development of hip OA to some occupations.[114]

II *Sports Exposure* Epidemiological studies have demonstrated participation in certain competitive sports to increase the risk for OA.[25,115] Running has low risk for OA,[107] but high-intensity, direct-impact activities, such as American football and hockey, appear to increase the risk of hip OA.[24,25]

I *Previous Injury* Proximal hip fracture results in changes to the articular surfaces of the hip joint that creates abnormal joint load bearing and has been shown to be related to the development of hip OA.[60] A history of a previous hip injury is also associated with hip OA.[35,177] Cooper et al[35] reported an odds ratio for hip OA when having a previous hip injury of 4.3 (95% CI: 2.2-8.4). In addition, patients with OA of 1 hip are at increased risk of developing OA in the opposite hip.[206]

III *Body Mass Index* A few studies have shown body mass index (BMI) to be related to hip OA.[35,116,200] Other studies, however, have shown little to no association between hip OA and BMI.[59,73,92,95,117] The most current evidence shows BMI is not related to hip OA.[161] What seems apparent is that obesity is probably associated with the progression of hip OA rather than onset,[127] and the therapeutic value of weight loss is important.[52,202]

II *Leg Length Disparity* Several studies have suggested that a difference in leg lengths may be an important etiological factor in hip OA.[63-65,68,140] A few studies have demonstrated the biomechanical and clinical problem of leg length disparity and its relationship to hip OA.[63-65] Nahoda[141] reported on the importance of correcting leg length disparity in the prevention of hip OA. Golightly[68] noted an association between radiographic hip OA and leg length disparity. A few papers on leg length disparity suggest a relationship with hip OA; however, more research is needed before leg length disparity can be considered an important risk factor. It should be pointed out that leg length disparity could also occur as a result of OA of the hip, particularly when there is superior migration of the femoral head in the acetabulum.

A Clinicians should consider age, hip developmental disorders, and previous hip joint injury as risk factors for hip osteoarthritis.

NATURAL HISTORY

The natural history of individual hip OA is imperfectly understood. Many different factors contribute to this. The clinical manifestations that develop in patients with hip OA include changes in the shape, density, length, and function of the bones, cartilage, and fibrous tissue surrounding the hip joint itself as well as the surrounding muscles. The changes that occur around the arthritic hip include a decrease in the joint space between the femur and acetabulum (more common superior and lateral than medial), shortening of the fibrous joint capsule, flattening of the femoral head, the appearance of osteophytic growth around the margins of the femoral head and acetabulum (in some individuals boney overgrowth does not occur), a superior-lateral or medial migration of the femoral head, and the development of subchondral sclerosis or cysts in the femoral head and acetabulum.[4,6,42,72,98,167] Changes that occur outside of the hip joint include a decreased amount of hip joint ROM (usually mostly affecting internal rotation and then flexion) and muscle weakness (particularly the abductor muscles), which eventually may result in difficulty with ambulation.[7,116,118,148] The progression of these changes are usually slow but may be quite rapid in some cases.[21] Currently, there is no reliable,

generally accepted classification of the stages or severity of hip OA and the rate of progression varies from patient to patient, even when the demographics of the patients are similar.[7]

DIAGNOSIS/CLASSIFICATION

I The diagnosis of hip OA can be made with a reasonable level of certainty on the basis of the history and physical examination.[2,16] Joint space narrowing along with other radiographic features including osteophytes and subchondral sclerosis on plain film radiographs is considered the definitive diagnosis.[6,19,37,42,45] The following clinical criteria are typically present in individuals who have radiographic findings consistent with hip OA.[2,16,18]

- Reports of moderate pain in the lateral or anterior hip with weight bearing. This pain may progress to the anterior thigh or knee region
- Adults, greater than 50 years of age
- Limited passive hip joint ROM in at least 2 of its 6 directions (flexion, extension, abduction, adduction, internal rotation, and external rotation)
- Morning stiffness, which improves in less than 1 hour

I Clinical criteria for the classification of patients with hip pain associated with OA were developed through a multicenter study by the American College of Rheumatology.[2] One hundred fourteen patients, with a mean age of 64 years and 87 controls with a mean age of 57 years, were included in the study. Patients were classified as having hip OA if they (1) reported experiencing hip pain, and (2) presented with either one of the following clusters of clinical findings:

- Hip internal rotation less than 15°, along with
- Hip flexion less than or equal to 115°
- Age greater than 50 years

Or,

- Hip internal rotation greater than or equal to 15°, along with
- Pain with hip internal rotation
- Duration of morning stiffness of the hip less than or equal to 60 minutes
- Age greater than 50 years

When patients were classified using these clinical criteria compared to a radiographic reference standard of joint space narrowing and osteophytes, the following diagnostic accuracy statistics were reported: sensitivity, 86%; specificity, 75%; positive likelihood ratio (LR+), 3.44; negative likelihood ratio (LR–), 0.19.[2]

Hip OA is classified as primary in the absence of any obvious underlying joint abnormality, or secondary if degeneration occurs as a result of a pre-existing abnormal joint problem.[81] Some suggest that all hip OA is secondary to some pre-existing problem (eg, dysplasia).[119] The clinical and/or radiological criteria presented above are usually sufficient to diagnose a patient with OA of the hip and the associated ICF impairment-based category of hip pain (b2816 Pain in joints) and mobility deficits (b7100 Mobility of a single joint).

II A recent preliminary study of patients with hip symptoms identified 5 possible clinical predictors for diagnosis: pain aggravated with squatting, lateral or anterior hip pain with the scour test, active hip flexion causing lateral hip pain, pain with active hip extension, and passive range of hip internal rotation less than 25°.[175] The LR+ of having hip OA when all 5 predictors were present was 7.3, while the LR– was .87.[175] One limitation of this study was the small sample of patients (21 of 79) who had hip OA on radiographs. This could have resulted in spurious findings. Future studies are needed to validate these results prior to clinical use.

I Birrell et al[18,19,20] also used a standard clinical and radiographic examination to assess the predictability of hip OA from hip ROM. In their study, 195 patients with recent onset of hip pain with radiographic evidence of OA had restricted movement at the hip compared with those without radiographic evidence of hip OA. Restriction in internal rotation was the most predictive and flexion the least predictive of radiographic OA. When comparing sides, a ROM difference of more than 15° between the painful and nonpainful side was considered a limitation of joint mobility. Restriction in hip ROM was predictive of the presence of OA. The diagnostic accuracy for restriction in a single plane of hip motion for patients with severe hip OA was as follows: sensitivity, 100%; specificity, 54%; LR+, 2.17; LR–, 0.01. The diagnostic accuracy for restriction in a single plane of hip motion for patients with moderate hip OA was the following: sensitivity, 86%; specificity, 42%; LR+, 1.48; LR–, 0.33. The diagnostic accuracy for restriction in all 3 planes of hip motion for patients with moderate hip OA was: sensitivity, 33%; specificity, 98%; LR+, 16.5; LR–, 0.67.[2,16,18]

A Moderate lateral or anterior hip pain during weight bearing, in adults over the age of 50 years, with morning stiffness less than 1 hour, with limited hip internal rotation and hip flexion by more than 15°, when comparing the painful to the nonpainful side, are useful clinical findings to classify a patient with hip pain into the International Statistical Classification of Diseases and Related Health Problems (ICD) category of unilateral coxarthrosis and the associated International Classification of Functioning, Disability, and Health (ICF) impairment-based category of hip pain (b2816 Pain in joints) and mobility deficits (b7100 Mobility of a single joint).

DIFFERENTIAL DIAGNOSIS

The following differential diagnoses should be considered in an individual with signs or symptoms suggestive of hip OA:

- Bursitis or tendinitis
- Chondral damage or loose bodies
- Femoral neck or pubic ramus stress fracture
- Labral tear
- Muscle strain
- Neoplasm
- Osteonecrosis of the femoral head
- Paget's disease
- Piriformis syndrome
- Psoriatic arthritis
- Rheumatoid arthritis
- Sacroiliac joint dysfunction
- Septic hip arthritis
- Referred pain as a result of an L2-3 radiculopathy

The following physical examination measures may be helpful in the differential diagnostic process when differentiating hip pain from other sources of pain:

- The Scour test for labral tears[175]
- FABER (Patrick's) test for labral tears[137]
- Fitzgerald's test for labral tears[54]
- Flexion-adduction internal rotation tests for labral tears[112]
- Sacroiliac joint provocation tests for sacroiliac joint pain[110]
- Femoral nerve stretch test for L2-3 radiculopathy[184]

Clinicians should consider diagnostic classifications other than osteoarthritis of the hip when the patient's history, reported activity limitations, or impairments of body function and structure are not consistent with those presented in the diagnosis/classification section of this guideline, or, when the patient's symptoms are not diminishing with interventions aimed at normalization of the patient's impairments of body function.

IMAGING STUDIES

Imaging studies, specifically plain film radiographs, are confirmatory for moderate to severe hip joint OA; however, radiographs are less useful in demonstrating early osteoarthritic joint changes.[53,98] Joint space narrowing detected on radiographs may be a relatively late stage phenomenon of OA.[23] Joint space narrowing has been advocated as the best indicator and best predictor of arthritic change in patients with hip OA, with joint space narrowing occurring more superiolateral than superiomedial.[37,42,45] The normal hip joint space is 3 to 5 mm. A reduction of greater than or equal to 0.5 mm represents a clinically relevant and significant reduction in joint space width.[4] Hip joint OA is considered moderate when joint space is less than 2.5 mm and severe when joint space is less than 1.5 mm.[16] The development of newer imaging techniques, such as gadolinium enhanced magnetic resonance imaging, has been suggested as a method to detect deficiencies in cartilage structure that may represent early arthritic changes in young patients.[103]

In addition to joint space narrowing, other criteria, including osteophytic spurs and subchondral sclerosis, also are used to identify patients with hip OA.[6,19] The Kellgren/Lawrence scale has been used to classify degenerative findings associated with hip OA. The scale consists of 4 grades: grade 1, no radiographic evidence of OA; grade 2, doubtful narrowing of joint space and possible (minute) osteophytes; grade 3, moderate definite osteophytes, definite moderate narrowing of joint space; grade 4, large osteophytes, severe joint space narrowing, subchondral sclerosis, and definite deformity of bone contour.[99] A potential caveat when using the Kellgren/Lawrence scale is spurs or osteophytes are emphasized[138,144] and not all patients with hip OA have osteophytes.

CLINICAL GUIDELINES

Examination

OUTCOME MEASURES

I The most commonly used outcome measure for hip OA is the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC).[14] The WOMAC has been validated and its reliability has been shown in many different studies and in many different countries.[12,169,183,198,212] The ordinal-scale version of the index consists of 24 questions (5 about pain, 2 about stiffness, and 17 about physical function), which are assigned a score of between 0 (extreme) and 4 (none). Individual question scores are then summed to form a raw score ranging from 0 (best) to 96 (worst). Finally, raw scores are normalized by multiplying the raw score by 100/96, creating a score of between 0% (best) to 100% (worst). Test-retest reliability of the WOMAC as measured by intraclass correlation coefficients (ICCs) has been shown to be good, ranging between 0.74 and 0.89.[166] The minimal clinically important difference (MCID) for the WOMAC score, as a change from the baseline score, has been reported in the range of 12% to 22%.[9,10,46] Angst el al[9] found the MCID for improvement in a sample of 192 patients with lower extremity OA to be in the range of 17% to 22% change from the baseline score. A prospective cohort study consisting of 122 patients diagnosed with hip or knee OA from an inpatient rehabilitation clinic found a 12% change from the baseline score as the MCID for the WOMAC.[10]

I The Lower Extremity Functional Scale (LEFS) is another reliable and valid outcome measure that is often administered to patients with hip OA.[17] The LEFS uses an ordinal scale from 0 ("extreme difficulty or unable to perform the activity") to 4 ("no difficulty") for the patient to rate the ability to perform 20 different activities, such as getting into or out of the bath tub, sitting for 1 hour, squatting, and rolling over in bed. The total score ranges from 0 to 80, with 80 representing maximum function based on the scale. The reliability and validity of the LEFS have been shown to be good when determined using a sample of 107 patients with lower extremity musculoskeletal problems. In that same study, the minimum detectable change (MDC_{90}) and $MCID_{90}$ were both 9 scale points.[17]

I Another often used functional outcome measure is the Harris Hip Score.[77] The Harris Hip Score is derived from scoring 10 different variables, including pain, ROM, gait/limp, gait distance, function, activities of daily living, and deformity. Scores range from 0 (worst) to 100 (best).[77]

A Clinicians should use validated functional outcome measures, such as the Western Ontario and McMaster Universities Osteoarthritis Index, the Lower Extremity Functional Scale, and the Harris Hip Score before and after interventions intended to alleviate the impairments of body function and structure, activity limitations, and participation restrictions associated with hip osteoarthritis.

ACTIVITY LIMITATION AND PARTICIPATION RESTRICTION MEASURES

6-Minute Walk Test

ICF category	Measurement of activity limitation: walking long distances
Description	A physical performance measure which assesses how far a person can walk in 6 minutes[48]
Measurement method	During the performance of the 6-minute walk test (6MWT), patients are instructed to cover as much distance as possible during the 6-minute time frame, with the opportunity to stop and rest if required. The test is conducted on an unobstructed level surface. The course is marked off in meters, and the distance traveled by each subject is measured to the nearest meter. Standardized verbal encouragement, "You are doing well, keep up the good work" is provided at 60-second intervals. Patients are permitted to use their regular walking aids if needed.[102]
Nature of variable	Continuous
Units of measurement	Meters
Measurement properties	The 6MWT showed high test-retest reliability ($ICC_{2,1}$ of 0.95-0.97).[170] Kennedy et al[102] also showed high test-retest reliability for the 6MWT with $ICC_{2,1}$ of 0.94 (95% CI: 0.88-0.98). The MDC_{90} for the 6MWT determined from a sample of 150 subjects with hip and knee OA, of which 69 underwent total hip arthroplasty (THA) was 61.34 m.[102]

Self-Paced Walk Test

ICF category	Measurement of activity limitation: walking short distances
Description	A physical performance measure which assesses how fast a person can walk for 4 m and for 40 m
Measurement method	During the performance of the self-paced walk test (SPWT), patients are instructed to "walk as quickly as you can without overexerting yourself" and timed with a stopwatch while they walk 2 lengths (turn excluded) of a 20-m indoor course[102]
Nature of variable	Continuous
Units of measurement	Seconds
Measurement properties	The test-retest reliability of the SPWT for 40 m has been examined by Kennedy et al.[102] They found an ICC of 0.91 (95% CI: 0.81-0.97). Kennedy et al[102] also showed the SPWT was responsive in detecting deterioration and improvement in the early postoperative period following arthroplasty. The MDC_{90} for the 40-m SPWT determined from a sample of 150 subjects with hip and knee OA of which 69 underwent THA was 4.04 seconds.[102] In a cohort of 492 older adults the recommended criterion for substantial meaningful change for gait speed at 10 ft, 4 m, and 10 m was 0.1 m/s.[149]

Stair Measure

ICF category	Measurement of activity limitation: climbing
Description	A physical performance measure, which assesses how well a person, can ascend and descend a flight of stairs
Measurement method	During the performance of the stair measure (SM) patients are instructed to ascend and descend 9 steps (step height, 20 cm) in their usual manner, and at a safe and comfortable pace[102]
Nature of variable	Continuous
Units of measurement	Seconds
Measurement properties	The test-retest reliability of the SM has been examined by Kennedy et al.[102] They found an ICC of 0.90 (95% CI: 0.79-0.96).[102] Kennedy et al[102] also showed the SM to be responsive in detecting deterioration and improvement in the early postoperative period following arthroplasty. The MDC_{90} for the SM, determined from a sample of 150 subjects with hip and knee OA, of which 69 underwent THA, was 5.5 seconds.[102]

Timed Up-and-Go Test

ICF category	Measurement of activity limitations: getting in an out of a seated position, walking short distances
Description	A physical performance measure which assesses how well a person can get up from a chair with arm rests, walk a short distance (3 m), turn around, return, and then sit down again[128]
Measurement method	During the performance of the timed up-and-go test (TUG), the patient sits in a chair with arm rests and is asked to stand up from the chair and walk as quickly and safely as possible to a cone 3 m away, turn, walk back to the chair, and sit down again. The performance of this test is timed.
Nature of variable	Continuous
Units of measurement	Seconds
Measurement properties	There was good agreement among observers on the subjective scoring of the TUG, and good correlation with the Berg balance scale, gait speed, Barthel's Index of activities of daily living, and predicted patient's ability to walk outside safely.[151] Podsiadlo[151] showed that the TUG had good intertester and intratester reliability (ICC = 0.99). Steffen et al[170] also showed the TUG had high test-retest reliability ($ICC_{2,1}$ = .95-.97). Podsiadlo[151] provided evidence for the criterion-related validity of the TUG by showing it correlates well with other functional scales. Kennedy et al[102] showed the TUG was responsive in detecting deterioration and improvement in postoperative time period following arthroplasty. The MDC_{90} for the TUG, determined from a sample of 150 subjects with hip and knee OA, of which 69 underwent THA, was 2.5 seconds.[102]

PHYSICAL IMPAIRMENT MEASURES

Passive Hip Internal and External Rotation and Hip Flexion

ICF category	Measurement of impairment of body function: mobility of a single joint
Description	The amount of passive hip rotation and passive hip flexion measured prone and supine, respectively. Although assessing the range in all 6 directions (3 planes) of hip motion is important in patients with hip OA, for brevity, we included the 3 most commonly limited hip motions. The patient is also asked to rate the amount of pain experienced during the movement on a 0-to-10 numerical pain rating scale (NPRS).
Measurement method	**Hip Internal and External Rotation:** The patient is positioned prone with feet over the edge of the treatment table. The hip measured is placed in 0° of abduction, and the contralateral hip is placed in about 30° of abduction. The reference knee is flexed to 90°, and the lower extremity is passively moved to produce hip rotation. The movement arm of the goniometer is aligned vertically along the shaft of the tibia while the stationary arm is aligned along an imaginary vertical line. Manual stabilization is applied to the pelvis to prevent pelvic movement and also at the tibiofemoral joint to prevent motion (rotation or abduction/adduction), which could be construed as hip rotation.[78] The tibia is then moved in the frontal plane to produce hip internal and external rotation. The motion is stopped and measurements taken when the extremity achieves its end range of passive hip rotation or when pelvic movement is necessary for additional movement of the lower extremity. An inclinometer may also be used to measure hip rotation. The inclinometer is first "calibrated" by placing it along the distal shaft of the vertically aligned tibia, just proximal to the medial malleolus and then setting the inclinometer dial to zero. Then, the extremity is passively moved to produce hip rotation and inclinometer measure is taken when the hip achieves its end range of passive internal and external rotation.[47] **Hip Flexion:** With the patient in the supine position, the hip is passively flexed with the movement arm of the goniometer along the long axis of the femur and the stationary arm of the goniometer along the long axis of the trunk, while stabilizing the lumbar spine to avoid any posterior pelvic tilt.[83]
Nature of variable	Continuous (ROM) and ordinal (pain)
Units of measurement	Degrees and 0-to-10 NPRS
Measurement properties	Limited ROM is associated with high levels of disability in patients with hip OA.[172] The reliability for hip rotation and hip flexion ROM measurements has been shown to be excellent, ICC of 0.95 to 0.97[47] for rotation and ICC of 0.94 (95% CI: 0.89-0.97)[30] for flexion. ROM measurements in 22 individuals with hip OA demonstrated excellent intrarater test-retest reliability (ICC = .97) for hip flexion.[152] Croft et al[38] showed good agreement among 6 testers when assessing for hip rotation and hip flexion in patients with hip OA. Steultjens et al[172] also showed good reliability when assessing the hip joint in patients with OA. The MDC_{95} for hip flexion, determined using 22 patients with knee OA and 17 subjects without lower extremity symptoms or known pathology, is 5°, meaning any change more than 5° is considered to be change beyond measurement error.[30] The MDC_{95} for pain with hip flexion is 1.2 on the 0-10 NPRS.[30] The clinically important difference for the NPRS, derived from patients with low back pain, has been shown to be a reduction of 2 points.[27,51]

Hip Abductor Muscles Strength Test

ICF category	Measurement of impairment of body function: power of isolated muscles and muscle groups
Description	A test to determine the strength of the hip abductor muscles
Measurement method	The hip abductor muscles strength test is performed with the subject in the supine position and the hip in a neutral position of flexion/extension, abduction/adduction, and external/internal rotation. A "make" test using a handheld dynamometer is used by asking the subject to push the most they can against the handheld dynamometer applied on the lateral aspect of the distal thigh, just above the knee. The hip abductor muscles may also be tested in the side lying position with the hip in abduction and slight extension. A "break" test is performed by the tester applying force via the handheld dynamometer applied on the lateral aspect of the distal thigh just above the knee. The direction of force application is toward adduction and slight flexion while the pelvis is stabilized with the other hand.[101]
Nature of variable	Continuous
Units of measurement	Force in Newtons
Measurement properties	Interrater and intrarater reliability of force measurements obtained from college age women were excellent using a handheld dynamometer for the abductor muscles (intrarater ICC, .88-.96; interrater ICC, .90-.95).[31] Force measurements of hip abductors in 22 individuals with hip OA demonstrated good intrarater test-retest reliability (ICC of .84).[152] The MDC_{95}, determined from a sample of 90 subjects (age range, 22-70 years) without any previous musculoskeletal problems, was 5.4% of body weight for males and 5.3% of body weight for females.[213]

The FABER (Patrick's) Test

ICF category	Measurement of impairment of body function: pain in joints
Description	A test to determine the irritability of the hip joint
Measurement method	The FABER test is administered with the subject in supine, the heel of the lower extremity to be tested placed over the opposite knee. The hip joint is passively externally rotated and abducted by the examiner applying manual pressure over the ipsilateral knee, while stabilizing the contralateral innominate with the opposite hand. After being zeroed against a wall, the inclinometer is placed on the medial aspect of the tibia of the tested lower extremity, just distal to the medial tibial condyle. ROM measurement is taken at the point of maximal passive resistance or at the point where the patient stops the test secondary to pain.[30] The patient is also asked to rate the location of the pain as well as the amount of pain experienced during the movement on a 0-to-10 NPRS.
Nature of variable	Continuous (ROM) and ordinal (pain)
Units of measurement	0-to-10 NPRS
Measurement properties	Intrarater reliability of ROM (ICC = 0.96; 95% CI: 0.92-0.98) and pain (ICC = 0.87; 95% CI: 0.78-0.94) measurements was excellent for the FABER test.[30] Cibulka[28] found the FABER test was responsive in detecting improvement in ROM and in report of pain in patients with hip pain. The MDC_{95}, determined from a sample of 22 patients with knee OA and 17 subjects without lower extremity symptoms or known pathology, was 8° for ROM and 1.6 points on the NPRS.[30] The clinically important difference for the NPRS, derived from patients with low back pain, has been shown to be a reduction of 2 points.[27,51]

The Scour Test

ICF category	Measurement of impairment of body function: pain in joints
Description	A test to determine the irritability of the hip joint
Measurement method	The hip Scour test is performed with the patient lying in the supine position while the clinician flexes and adducts the hip until resistance to movement is detected. The clinician then maintains flexion into resistance and gently moves the hip into abduction, then bringing the hip through 2 full arcs of motion. If the patient reports no pain, then the examiner repeats the test while applying long-axis compression through the femur. This test must be administered with some caution so as to not irritate the hip joint. The patient is asked to rate the pain experienced during the movement on a 0-to-10 NPRS.[30]
Nature of variable	Ordinal
Units of measurement	0-to-10 NPRS
Measurement properties	The intratester reliability of the Scour test is good (ICC = 0.87; 95%CI: 0.76-0.93) for rating of hip pain.[30] The MCID for the NPRS has been shown to be a reduction of 2 points.[27,51] The MDC_{95} for the Scour test was determined from a sample of 22 patients with knee OA and 17 subjects without lower extremity symptoms or known pathology. The MDC_{95} for pain was a change of more than 1.6 points on the 0-to-10 NPRS.[30]

PROGNOSIS

In most cases, OA of the hip progresses slowly[197] with total hip replacement/arthroplasty (THR/THA) being the primary clinical endpoint for individuals with severe hip OA.[69] The prognosis of hip OA depends primarily on the extent of radiographic evidence of hip OA.[167] The severity and progression of hip OA is commonly assessed with the Kellgren/Lawrence scale of joint space narrowing on plain film radiographs.[99] A patient's baseline Kellgren/Lawrence radiographic grade is an important predictive factor for having THA.[44,160,199] Reijman et al[159] found that a Kellgren/Lawrence score of II or higher is a strong predictor of progression in patients with hip OA. Gossec et al[70] reported that a Kellgren/Lawrence grade of III had an odds ratio of 3.3 and a grade of IV had an odds ratio of 5.3 that patients would have a THA. Gossec et al[70] also reported that the most important predictive factors of having a THA include Kellgren/Lawrence radiographic grades of III or higher, a high global assessment of pain, and a previous trial of nonsteroidal anti-inflammatory drugs (NSAIDs).[4,70,72] Altman et al[5] have suggested that the measurement of individual radiographic features may be superior to the Kellgren/Lawrence global measurement in detecting arthritic progression. In OA of the hip, a single anteroposterior radiograph assessing for joint space narrowing and cyst formation yielded high sensitivity in

detecting change. The MCID for joint space narrowing progression is greater than 0.5 mm/y.[4,43] The rate of joint space narrowing in patients with slowly developing hip OA is less than 0.2 mm/y and in patients with rapidly developing hip OA greater than 0.2 mm/y.[66] In summary, joint space narrowing and the Kellgren/Lawrence scale are important prognostic predictors of OA while joint space narrowing may be the best indicator of structural OA progression in patients with hip OA.

Other indicators for performing a THA include previous use of NSAIDs and pain of at least 47 mm on a 100-mm pain scale for over 6 months.[70] Pain and function appear to be important criteria when considering THA.[215]

THA is the most common surgical procedure for end-stage hip OA. Despite the success of THA of the hip and knee over the last 30-plus years, the criteria for when to perform such surgery are not clear.[3] There have been several attempts to develop guidelines to determine the appropriate time to perform joint replacement surgery, however few are supported by research.[3] Currently, there is no consensus on the appropriate time to recommend surgery as a clinical end point.[3] However, the Group for the Respect of Ethics and Excellence in Science (GREES) suggests that conservative intervention has failed if a patient does not experience a reduction in symptoms, such as a 20% to 25% improvement on the pain subscale of the WOMAC, and has a progressive loss of joint space of between 0.3 and 0.7 mm/year.[3]

CLINICAL GUIDELINES

Interventions

A variety of interventions have been described for the treatment of hip OA and there is fair evidence from randomized clinical trials and systematic reviews to support the benefits of physical therapy intervention in these patients.

ANTI-INFLAMMATORY AGENTS

I Both over-the-counter and prescribed anti-inflammatory agents including NSAIDs, Cox-2 inhibitors, and steroid injections are recommended as part of a multidisciplinary treatment approach to hip OA.[216] Randomized clinical trials evaluating the use of NSAIDs have shown NSAIDs can be effective for the temporary relief of symptoms and improvement in function in patients with hip OA.[189] However, it should be noted that this class of drugs is not without risk for serious adverse events including increased gastrointestinal bleeding.[67]

I There is evidence to support the use of corticosteroid injection in patients with hip OA to provide short-term pain relief.[155,163] A recent placebo-controlled trial confirmed corticosteroid injection can be an effective treatment of pain in hip OA, with benefits lasting up to 3 months.[105]

I Some evidence does suggest some NSAIDs may increase the progression of hip OA by decreasing glycosaminogly can synthesis[22,86,147,159] however, further studies are needed.

ALTERNATIVE/COMPLEMENTARY MEDICATION

I Glucosamine and other similar supplements are commonly suggested for individuals with hip OA. To date, randomized controlled trials evaluating the use of glucosamines have shown mixed results.[130,131,205] Most of the positive results are for short-term improvement in pain and in function.[132] A recent meta-analysis of chondroitin (a specific glucosamine commonly found in articular cartilage) for OA of the hip indicates the symptomatic benefit of chondroitin is minimal or nonexistent and the use of chondroitin in clinical practice should be discouraged.[158] Glucosamines (also called glycosaminoglycans) are an important component of normal connective tissue physiology; however, the short or long-term use of glucosamines is not recommended at this time in patients with hip OA.

I There is some evidence to support the short-term use of injectable viscosupplementation with hyaluronic acid into hip joint of patients with hip OA.[34] Despite a paucity of evidence, the use of injectable synthetic hyaluronic acid (hyaluronan) into the hip joint has been shown to be an effective treatment for symptomatic hip OA.[33,194,195] Evidence also shows that injectable hyaluronan works best in mild to moderate hip OA, especially when conservative therapy has failed.[39] A recent published meta-analysis suggests the benefit of hyaluronan for the treatment of hip OA,[34] but so far it is only approved by the Federal Drug Administration (FDA) for the knee. More controlled studies are needed to show its effectiveness in patients with hip OA.[34]

PATIENT EDUCATION

I Studies have shown the benefit of patient education in the self-management of patients with arthritis in decreasing pain, improving function, reducing stiffness and fatigue, and reducing medical usage.[26,58,87,88,216] A meta-analysis has shown patient education can provide on average 20% more pain relief when compared to NSAIDs alone in patients with hip OA or rheumatoid arthritis.[174]

II An approach, called Hip School, that includes primarily patient education as an intervention has been shown to be effective in a preliminary study for patients with signs and symptoms of hip OA.[104] The Hip School highlights the need for educating patients with hip OA, especially understanding the importance of preserving hip ROM and muscle function, understanding what therapy is effective and what is not, and when surgery is likely indicated.

B Clinicians should consider the use of patient education to teach activity modification, exercise, weight reduction when overweight, and methods of unloading the arthritic joints.

FUNCTIONAL, GAIT, AND BALANCE TRAINING

II Patients with hip OA often have gait abnormalities such as asymmetry in weight bearing and step length.[29] Assistive device are often used in patients with hip OA to reduce the pain and activity limitations associated with this condition.[196] A cane in the contralateral hand and choosing to carry loads in the ipsilateral hand has been shown to be effective in reducing hip abductor muscles

activity[133,143] and acetabular contact pressures.[133,143] One study has shown a cane in the opposite hand can reduce hip load, reduce hip pain, and improve function in patients with hip OA.[142]

II Functional, gait, and balance training is recommended to address impairments of proprioception, balance, and strength, which are all commonly found in individuals with lower extremity arthritis. These deficits can contribute to higher fall risk scores in older individuals.[173] Functional training of a small cohort of elderly individuals with lower extremity impairment demonstrated improved functional performance. Subjects underwent a program consisting of exercises simulating activities of daily living (such as gait, rising from a chair, reaching, stepping, and squatting down) performed at 3 different speeds (self selected, fast, and slow) with progressive levels of difficulty. When subjects completed 1 task level correctly and without fatigue the next level was introduced.[134]

C Functional, gait, and balance training, including the use of assistive devices such as canes, crutches, and walkers, can be used in patients with hip osteoarthritis to improve function associated with weight-bearing activities.

MANUAL THERAPY

I Some evidence exists for using manual therapy to increase hip joint ROM and reduce pain short-term in patients with hip OA, especially in patients who do not have signs of severe hip OA (eg, osteophytes and significant joint space narrowing).[82]

One study has recommended mobilization/manipulation as a component of the management program for patients with hip OA.[82] This randomized controlled trial compared the use of manual therapy and therapeutic exercises in patients with hip OA.[82] The manual therapy session consisted of (1) stretching techniques of shortened muscles surrounding the hip joint, (2) traction of the hip joint, (3) traction manipulation (high-velocity thrust technique) in each limited position. All manipulations were repeated during each session until the therapist concluded optimal results of the session were achieved. The focus of the therapeutic exercise intervention was to improve hip ROM, muscle length, and strength along with walking endurance. The outcomes for hip function (Harris Hip Score), ROM, and pain as measured by the visual analogue scale were compared for specific subgroups of hip OA depending on limited function, ROM, or level of pain.[82] After 5 weeks of intervention, the success rate (primary outcome) of manual therapy was 81% versus 50% for exercise therapy (odds ratio, 1.92; 95% CI: 1.30-2.60).[82] Manual therapy was found to be superior to exercise therapy in some patients with hip OA but was not shown to be any more effective than exercise in patients with highly limited function, ROM, or high levels of pain.[82] When intervention stopped, the improvements in function declined after 5 weeks. However, some improvement lasted up to 29 weeks for the patients in the manual therapy group.[82]

IV MacDonald et al[123] published a case series describing the outcomes of individual patients with hip OA treated with manual physical therapy and exercise. The series included 7 patients diagnosed with hip OA on the basis of the clinical examination. All patients were treated with manual physical therapy followed by exercises to increase hip strength and ROM. Six of 7 patients completed a Harris Hip Score at initial examination and discharge from physical therapy. Patients exhibited reductions in pain and increases in passive ROM, as well as a clinically meaningful improvement in function.[123]

Harding et al,[76] in a study using cadaveric models, showed that a posterior-anterior (P/A) mobilization of the hip produced about 1 mm of movement in the hip joint when using a force of 356 N. Distal distraction of the hip, however, created motion ranging from 2 to 7 mm of displacement when using forces between 89 to 356 N.[76] This cadaveric study suggests that when attempting to mobilize the hip joint, the amount of movement produced at the hip most likely depends on the direction the joint is mobilized.[76]

Risks of adverse events associated with manual therapy of the hip typically include self-limiting soreness of the hip region. There are no studies documenting an increased risk for serious adverse events associated with manual therapy of the hip.

B Clinicians should consider the use of manual therapy procedures to provide short-term pain relief and improve hip mobility and function in patients with mild hip osteoarthritis.

FLEXIBILITY, STRENGTHENING, AND ENDURANCE EXERCISES

There are 3 categories of exercise therapy employed for OA: ROM/flexibility exercises, muscle-strengthening exercises, and aerobic conditioning/endurance exercises. Often all 3 types of exercises are utilized jointly for patients with hip OA. Adequate joint motion and elasticity of periarticular tissues are necessary for cartilage nutrition and health, protection of joint structures from damaging impact loads, function, and comfort in daily activities. Exercise to regain

or maintain motion and flexibility is achieved by routines of low-intensity, controlled movements that do not cause increased pain.[52] Muscle weakness around an osteoarthritic joint is a common finding.[171] Progressive resistive/strengthening exercises load muscles in a graduated manner to allow for strengthening while limiting tissue injury. Aerobic exercise has been shown to be helpful in patients with hip OA.[216] Aerobic exercises are usually designed to provide a workload to the cardiovascular and pulmonary system at 60% to 80% of maximal capacity and sustained for duration of at least 20 minutes.[216]

II ROM and strengthening exercises have been advocated by many authors as a component of the management for patients with hip OA.[32,56,80,85,123,135,150,157,164,165,176,190,192,193,216] Van Baar et al[191] showed that exercise is effective in patients with OA of the hip using an exercise program previously reported by Oostendorp et al[146] that consisted of flexibility, hip muscle strengthening, and an aerobic exercise program. The emphasis of the stretching was on hip muscles, including the iliopsoas, rectus femoris, and hip adductors. Before stretching it was advised to heat the specific muscle and then stretch gently without excessive force for 15 to 30 seconds, performed 5 to 10 times preferably daily, but at least 3 times a week. Hip muscle strengthening was performed with either free weights or exercise machines.[146,191] Depending on the therapist's findings on evaluation and the patient's needs and goals, the specific type, intensity, frequency, and duration of exercise were determined. The typical exercise prescription ranged from 1 to 3 times per week with a duration of 30 minutes for each exercise session for 12 weeks.[191] Treatment could be discontinued within the 12-week period if, according to the therapist, the treatment goals were achieved. When patients stopped exercising after 12 weeks, Van Baar et al[191] reported that the beneficial effects of reduced pain, less use of medication, and improved function declined, losing any earlier gain that were made.[192] A confounding factor of the Van Baar et al[192] trial was that data from patients with hip OA were pooled with data from patients with knee OA. Therefore, determining specific treatment effect in patients with hip OA was not possible.

II Many of the published articles on exercise report findings that combine subjects with either hip or knee OA. However, in a recent meta-analysis, Hernandez-Molina et al[79] contacted authors of several studies and obtained data which only pertained to hip OA. They found 9 articles where hip-strengthening exercises showed a beneficial effect in reducing pain and improving function in patients with hip OA.[79] In another study, moderate evidence was found for long-term effectiveness on reduced pain, improved self-reported physical function, and improved observed physical function with exercise for patients with hip OA.[150] Studies have also shown aerobic exercise may offer additional improvement in function when combined with stretching and strengthening.[153,216]

II Minor et al[136] studied 120 patients with well-defined rheumatoid arthritis (n = 40) or OA (n = 80) of the hip, knee, or ankle. Patients received 1 of 3 interventions: a stretching and strengthening exercise program (control), or the same program combined with 1 of 2 aerobic conditioning/endurance exercises: pool activities or walking. All patients participated in a 12-week program, which met 3 times each week for 1 hour, and all performed supervised ROM and isometric exercises. The 2 groups doing the aerobic exercises also performed up to 30 minutes of walking or pool exercises to increase their heart rates to 60% to 80% of each person's estimated baseline maximum. At 12 weeks, study participants were assessed for changes in aerobic capacity, flexibility (trunk bending, shoulder ROM, and ankle ROM), function tests (exercise endurance on a treadmill test, time to walk 50 feet, and reported daily activity), and self-reported health status using the Arthritis Impact Measurement Scale, which is an arthritis-specific functional status instrument that reliably measures psychological health, physical health, and pain. Patients in both of the aerobic exercise groups increased aerobic capacity and decreased times to walk 50 feet compared to their baseline scores and compared to the patients in the control group. Following 12 weeks of supervised exercises, all groups demonstrated improved trunk, shoulder, and ankle joint flexibility. The gains in endurance and flexibility in all 3 groups were achieved without exacerbating the study participant's arthritis signs and symptoms.

II The use of aquatic exercise (hydrotherapy) in the treatment of patients with OA of the hip has been assessed.[13,32,55,57,71,80] Aquatic exercise appears to have some beneficial short-term effects for patients with hip and/or knee OA while no long-term effects have been documented.[13] In a recent study Hinman et al[80] used a randomized controlled trial and compared a 6-week program of aquatic physical therapy to no intervention. The aquatic physical therapy group demonstrated significantly less pain and improved physical function, strength, and quality of life after the intervention.[80] However, effect size calculations revealed only small benefits of aquatic physical therapy for pain, stiffness, right hip abductors strength, and quality of life, and doubtful clinical benefits for physical function and left hip abductors strength.[80] Patients who have an intolerance to land-based exercise because of pain or obesity may better tolerate aquatic based exercise.[80]

B Clinicians should consider the use of flexibility, strengthening, and endurance exercises in patients with hip osteoarthritis.

CLINICAL GUIDELINES

Summary of Recommendations

B PATHOANATOMICAL FEATURES

Clinicians should assess for impairments in mobility of the hip joint and strength of the surrounding muscles, especially the hip abductor muscles, when a patient presents with hip pain.

A RISK FACTORS

Clinicians should consider age, hip developmental disorders, and previous hip joint injury as risk factors for hip osteoarthritis.

A DIAGNOSIS/CLASSIFICATION

Moderate lateral or anterior hip pain during weight bearing, in adults over the age of 50 years, with morning stiffness less than 1 hour, with limited hip internal rotation and hip flexion by more than 15° when comparing the painful to the nonpainful side are useful clinical findings to classify a patient with hip pain into the International Statistical Classification of Diseases and Related Health Problems (ICD) category of unilateral coxarthrosis and the associated International Classification of Functioning, Disability, and Health (ICF) impairment-based category of hip pain (b2816 Pain in joints) and mobility deficits (b7100 Mobility of a single joint).

E DIFFERENTIAL DIAGNOSIS

Clinicians should consider diagnostic classifications other than osteoarthritis of the hip when the patient's history, reported activity limitations, or impairments of body function and structure are not consistent with those presented in the diagnosis/classification section of this guideline - or - when the patient's symptoms are not diminishing with interventions aimed at normalization of the patient's impairments of body function.

A EXAMINATION – OUTCOME MEASURES

Clinicians should use validated functional outcome measures, such as the Western Ontario and McMaster Universities Osteoarthritis Index, the Lower Extremity Functional Scale, and the Harris Hip Score before and after interventions intended to alleviate the impairments of body function and structure, activity limitations, and participation restrictions associated with hip osteoarthritis.

A EXAMINATION – ACTIVITY LIMITATION AND PARTICIPATION RESTRICTION MEASURES

Clinicians should utilize easily reproducible physical performance measures, such as the 6-minute walk, self-paced walk, stair measure, and timed up-and-go tests to assess activity limitation and participation restrictions associated with their patient's hip pain and to assess the changes in the patient's level of function over the episode of care.

B INTERVENTIONS – PATIENT EDUCATION

Clinicians should consider the use of patient education to teach activity modification, exercise, weight reduction when overweight, and methods of unloading the arthritic joints.

C INTERVENTIONS – FUNCTIONAL, GAIT, AND BALANCE TRAINING

Functional, gait, and balance training, including the use of assistive devices such as canes, crutches, and walkers, can be used in patients with hip osteoarthritis to improve function associated with weight-bearing activities.

B INTERVENTIONS – MANUAL THERAPY

Clinicians should consider the use of manual therapy procedures to provide short-term pain relief and improve hip mobility and function in patients with mild hip osteoarthritis.

B INTERVENTIONS – FLEXIBILITY, STRENGTHENING, AND ENDURANCE EXERCISES

Clinicians should consider the use of flexibility, strengthening, and endurance exercises in patients with hip osteoarthritis

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