# HIP DISABILITY

## PATIENT EDUCATION, CLASSIFICATION AND ASSESSMENT

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Det som inte bryter ner mig
gör mig starkare.
Friedrich Nietzche

# Abstract

Hip disability is common and entails activity limitations, participation restrictions and increased risk of further disability and health problems, partially due to inactivity. *Hip osteoarthritis* (OA), the major diagnosis, is difficult to define, especially when no joint space narrowing is seen in radiography. However, radiological hip OA can be asymptomatic. The American College of Rheumatology (ACR) has developed clinical classification criteria for symptomatic hip OA, including two range-of-motion (ROM) variables: flexion and internal rotation. It has been clinically accepted that hip OA, with joint capsule involvement, occasions a "capsular pattern" of decreased ROM, but the exact ordering of the directions is controversial. Patient education in groups is an important supplement to individual treatment and is recommended by the ACR and the European League of Associations of Rheumatology for patients with OA.

The overall objective of the present thesis was to develop early educational treatment in primary care for people with hip disability – a Hip School – and to assess its effects on self-rated hip problems and health-related quality of life. Further objectives were to analyse common diagnostic and classification criteria and to improve instruments for assessing self-rated hip problems.

The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), available in both knee and hip formats, was translated into Swedish and tested. A Hip School led by physiotherapists was developed covering, among other things, self-help hints (e.g. advice about daily physical activity to appropriate extent for at least a total of 30 minutes, hip ROM training at the end point of motion, and not sitting for longer than 20 minutes at a time). For assessment of the Hip School, persons with hip disability were recruited to a treatment group ($n$ = 77) or to a control group ($n$ = 68). Self-rated hip problems were assessed with the WOMAC and health-related quality of life with the Nottingham Health Profile (NHP) before and 6 months after the Hip School. The treatment group was also tested after an additional 6 months. For 168 persons with hip disability, passive range of motion (PROM) was tested in six directions with a goniometer. PROM limitations were calculated with three different norms and arranged by size in PROM patterns. The patterns and the number of hips with patterns corresponding to proposed capsular patterns were counted. Fifty-two persons with hip disability answered an extended version of the WOMAC twice with a one-week interval. Reproducibility, percentage of zero scores (best possible score) and mean scores of symptoms and perceived importance were analysed.

The results showed that the Swedish version of WOMAC is a reliable, valid, and responsive instrument with measurement qualities in agreement with the original version. Assessment of the Hip School showed that the participants reduced their pain and activity limitations and improved their health-related quality of life after 6 months with maintained effects after one year. It was not possible to predict radiological evidence of hip OA from the multitude of PROM patterns. No support was found for the existence of a hip joint "capsular pattern". The failure of the clinical signs to coincide satisfactorily with radiographic hip OA was further emphasised when the ACR clinical classification criteria were used, as they achieved a sensitivity of 85% and a specificity of 25%. Gender and other factors such as age, ROM exercise and other ROM-demanding habits influence PROM. Being male contributed almost as much as having hip OA to the risk of having decreased hip PROM. The extended instrument Hip disability and osteoarthritis outcome score (HOOS), appears to be evaluative with increased ability, especially in early-stage hip disability, to detect clinically important change over time.

It is concluded that the Hip School can be a useful early treatment strategy for persons with hip disability. It is not possible to diagnose hip OA with "capsular patterns" or to classify hip OA in early cases from reduction in PROM directions. HOOS can be used to assess treatment strategies.



Keywords: activity limitations, assessment, capsular pattern, classification, disability, hip, HOOS, NHP, osteoarthritis, pain, physiotherapy, range of motion, stiffness, quality of life, WOMAC



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## **Sammanfattning** (summary in Swedish)

Höftbesvär är vanliga och kan leda till funktionsnedsättningar, aktivitetsbegränsningar och ökar risken för ytterligare funktionsnedsättningar och påverkan på hälsan i övrigt, delvis beroende på inaktivitet. Höftartros, ledsvikt, den dominerande diagnosen är svår att definiera. Det saknas säkra diagnostiska kriterier i de fall ledspringan vid slätröntgen inte är sänkt, samtidigt som man med dagens diagnoskriterier kan ha höftartros helt utan symptom. American College of Rheumatology (ACR) har utarbetat förslag till kliniska kriterier för klassificering av symptomatisk höftartros innehållande två ledrörlighetsvariabler: ett för flexion och ett för inåtrotation. Det har länge varit vedertaget att höftartros, med påverkan på höftledens ledkapsel medförande skrumpning, inskränker ledrörligheten i en viss ordningsföljd, så kallat ”kapsulärt mönster”. Däremot råder oenighet mellan forskare om ordningsföljden av inskränkningarna i de olika rörelseriktningarna. Patientundervisning i grupp är ett viktigt komplement till individuell behandling, rekommenderat både av ACR och European League of Associations of Rheumatology.

Avhandlingens övergripande syfte var att utveckla tidig patientundervisning i primärvården för personer med höftbesvär – en Höftskola – och att utvärdera effekterna av denna vad gäller förmågan att minska självskattade höftbesvär och förbättra hälsorelaterad livskvalitet. Övriga syften var att analysera vanliga diagnostiska kriterier och klassifikationskriterier samt att förbättra utvärderingsinstrument för självskattade höftbesvär.

Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), tillgänglig i både knä och höftformat, översattes till svenska och testades. En Höftskola ledd av sjukgymnast innehållande bl. a. egenvårdstips (t.ex. lagom fysisk aktivitet minst sammanlagt 30 minuter om dagen, daglig höftrörlighetsträning i ytterlägen och att inte sitta längre än 20 minuter i taget), har utvecklats. För utvärdering av Höftskolan rekryterades personer med höftbesvär till en behandlingsgrupp (n = 77) eller till en kontrollgrupp (n = 68). Självskattade höftbesvär mättes med WOMAC och hälsorelaterad livskvalitet med Nottingham Health Profile före och 6 månader efter genomgången Höftskola. Behandlingsgruppen testades också efter ytterligare 6 månader. För 168 personer med höftbesvär mättes passiv höftrörlighet (PROM) i sex rörelseriktningar med goniometer. Inskränkningar av PROM räknades fram med tre olika rörlighetsnormer och arrangeras i storleksordning i PROM-mönster. Antalet mönster och antalet höfter med mönster som överensstämde med föreslagna kapsulära mönster räknades. Femtiotvå personer med höftbesvär svarade på en utökad version av WOMAC vid två tillfällen med en veckas mellanrum. Reproducerbarhet, procentsatsen av noll-scorer (bästa tänkbara score) och medelscorer vad gäller symptom och hur viktiga symptomen ansåg vara analyserades.

Resultaten visar att den svenska versionen av utvärderingsinstrumentet WOMAC är reliabelt, valitt och responsivt med likartade mätegenskaper som originalet. Utvärdering av Höftskolan, visade att de som deltog minskade sina självskattade höftbesvär och ökade sin hälsorelaterade livskvalitet efter 6 månader, med kvarstående effekt efter 1 år. Uppfattningen att den passiva höfledsrörligheten kan förutsäga röntgenologisk höftartros och att det existerar ett så kallat ”kapsulärt mönster” för höften kan avfärdas. De kliniska tecknens oförmåga att sammanfalla med röntgenologisk höftartros förstärks ytterligare då ACR's föreslagna kliniska klassifikationskriterier användes och erhöll en sensitivitet på 85% och en specificitet på 25%. Kön, och andra faktorer som ålder, om man tränar sin rörlighet, ofta sitter på huk eller har andra rörlighetskrävande beteenden påverkar passiv ledrörlighet. Att vara man visade sig bidra nästan lika mycket som att ha höftartros till risken att ha nedsatt höftledsrörlighet. Det utökade utvärderingsinstrumentet Hip disability and osteoarthritis outcome score (HOOS), verkar ha bättre förutsättningar att uppfatta meningsfull förändring särskilt av tidiga höftbesvär.

Höftskola föreslås som tidig behandling av personer som söker sjukvården för höftbesvär. Det är inte möjligt att diagnostisera höftartros med hjälp av kapsulärt mönster eller att klassificera höftartros i tidiga skeden genom att mäta höftrörlighet. HOOS kan användas för att dokumentera effekter av behandling av höftbesvär.



Nyckelord: activity limitations, assessment, capsular pattern, classification, disability, hip, HOOS, NHP, osteoarthritis, pain, physiotherapy, range of motion, stiffness, quality of life, WOMAC



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## List of papers

This thesis is based on the following papers, which will be referred to in the text by their Roman numerals:

I. Roos EM, Klässbo M, Lohmander LS. WOMAC Osteoarthritis Index – Reliability, validity, and responsiveness in patients with arthroscopically assessed osteoarthritis. Scandinavian Journal of Rheumatology 1999;28:210-215.

II. Klässbo M, Larsson G, Harms-Ringdahl K. Promising outcome of a 'Hip School' for patients with hip dysfunction. Arthritis Care & Research, in press.

III. Klässbo M, Harms-Ringdahl K, Larsson G. Examination of passive range-of-motion and the capsular patterns in the hip. Physiotherapy Research International, in press.

IV. Klässbo M. Validation of ROM variables of the American College of Rheumatology clinical criteria for classifying osteoarthritic hip pain. Submitted.

V. Klässbo M, Larsson E, Mannevik E. Hip disability and osteoarthritis outcome score. An extension of the Western Ontario and McMaster Universities Osteoarthritis Index. Scandinavian Journal of Rheumatology 2003;32:46-51.

Some additional data, new analyses, and results not previously published, have now been added.

## Contents

## Definitions

| | |
|---|---|
| **Hip joint** | A ball-and-socket joint and a functional unit consisting of bones, cartilage, synovium, capsule, ligaments, bursae, muscles, blood, lymphatic and nerve supply[1,2,3]. |
| **Hip disability** | Impairments of body functions and/or structures, activity limitations and/or participation restrictions according to World Health Organization[4], here when all other diagnostic entities than possible hip osteoarthritis are excluded[5,6]. |
| **Hip osteoarthritis (OA)** | A heterogeneous disease, if disease at all[7], that can affect all the tissues belonging to the hip joint[1,2]. Hip OA can be either symptomatic or asymptomatic[8]. Here a narrower concept has been used: diagnosed hip OA with a joint space narrowing classified by a radiologist on X ray[9]. |
| **Idiopathic hip OA** | Hip OA where the specific etiology has not yet been found. Sometimes called primary hip OA, but since hip OA is always secondary[10] the term 'idiopathic hip OA' is used in this thesis. |
| **Symptomatic hip OA** | Radiologically defined hip OA with some kind of symptom, pain, stiffness and/or activity limitation. |
| **Non-hip OA** | A person, or a person's hip, with hip disability with no other diagnose than possible hip OA, but where radiological joint space narrowing has not been classified by the radiologist on X ray. In ICD-10[11] coxarthrosis, unspecified. |
| **Self-rated hip problems** | Hip problems as reported by an individual. |
| **Measurement qualities** | Also metric properties of a questionnaire or test, including validity, reliability and responsiveness. |
| **Validity** | A measure of how far an assessment technique measures what it is intended to[12] or a process whereby we determine how much confidence we can place in inferences about people based on their scores from a questionnaire or test[13]. According to Streiner and Norman one of the most difficult aspects of validity testing is the terminology. In the present work, instead of trying to decide proper constructs or hyponyms, the actual procedures have been described. |
| **Reliability** | An expression of how far the same results are yielded in repeated applications of an assessment technique assuming no true interval change in the phenomenon studied. Reflects the amount of error, both random and systematic, inherent in any measurement[13]. |
| **Positive and negative predictive values** | The proportion of patients with positive/negative test results that are correctly diagnosed[14]. |
| **Internal consistency** | How well the different items in a sub-scale or scale correspond to each other[15]. |
| **Intraclass correlation coefficient** | A ratio of the variance of interest over the sum of the variance of interest plus error[16]. |
| **Per cent agreement with or without correction for chance** | The relative proportion of agreements with or without correction for random agreements[14]. |
| **Test-retest reliability** | Stability over time or reproducibility. |

| | |
|---|---|
| **Responsiveness** | The ability of an instrument to measure a meaningful or clinically important change in a state[17]. |
| **Sensitivity to change** | The ability of an instrument to measure change in state regardless of whether it is relevant or meaningful to the decision-maker. Sensitivity to change is a necessary but insufficient condition for responsiveness[17]. |
| **Sensitivity** | The proportion of positives that are correctly identified by the test[14]. |
| **Specificity** | The proportion of negatives that are correctly identified by the test[14]. |
| **Evaluative measure** | A measure with longitudinal construct validity, reliability and responsiveness[18]. |


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## Abbreviations

AAOS: American Academy of Orthopedic Surgeons

ACR: American College of Rheumatology

BMS: Mean square between subjects

CV: Coefficient of variation

EMS: Mean square residual

ES: Effect size

ESR: Erythrocyte sedimentation rate

EULAR: European League of Associations of Rheumatology

HOOS: Hip disability and osteoarthritis outcome score

ICC: Intraclass correlation coefficient

ICF: International Classification of Functioning, Disability and Health

ICIDH: International Classification of Impairment, Disability and Health

IQR: Inter-quartile range

JS: Joint space

KOOS: Knee injury and Osteoarthritis Outcome Score

NHP: Nottingham Health Profile

OA: Osteoarthritis

PROM: Passive range of motion

ROM: Range of motion

SD: Standard deviation

SEM: Standard error of measurement

SF-36: Short Form 36

SRM: Standardized response mean

THR: Total hip replacement

WMS: Mean square within subjects

WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index

## Introduction

The present work originated in ‘clinical irritations’ (Yerxa EJ). There were negative assumptions, both among patients and clinicians, about hip osteoarthritis (OA). It was often thought of as a degenerative, ‘wear and tear’ disease of articular cartilage, with little or no potential for repair or treatment (Dieppe 1984, Dieppe 1999). In 1984 there was a backlog of patients with hip problems on our waiting list for individual physiotherapy. Perhaps things could be speeded up a little and made more effective if we educated the patients in groups? Could there be 'spin-off' effects in terms of motivation, mutual help and so on? This was the start of the Hip School development. When I later presented the Hip School to the County Council Health Services Department in 1990, Chief Medical Officer Dr Magnusson pointed out that the Hip School could have effects on the national economy: he wanted it to be assessed. This was the start of this thesis.

The overall perspective in this thesis is the physiotherapist’s. The Swedish Association of Registered Physiotherapists has in 1997 defined physiotherapy as (Bergman 1997) ”Physiotherapy as a field of practice is concerned with prevention, examination, treatment and rehabilitation of movement disorders that limit or threaten to limit the movement capacity of the individual. …. Interventions with the aim to prevent or rehabilitate are based on an evaluation and analysis of physical capacity and problems of the patient/client with regard to psychological and social factors including relevant environmental aspects. With the patient/client as an active partner, interventions, treatments and learning strategies aim at making the individual aware of his/her physical resources and thereby improve the potential of the individual to cope with the demands of daily living. …. The physiotherapist is an autonomous practitioner and is responsible for evaluation of patient’s problem, choice of intervention strategies, implementation of interventions as well as evaluation of outcomes.”

The main concepts of this thesis are presented in Figure 1.

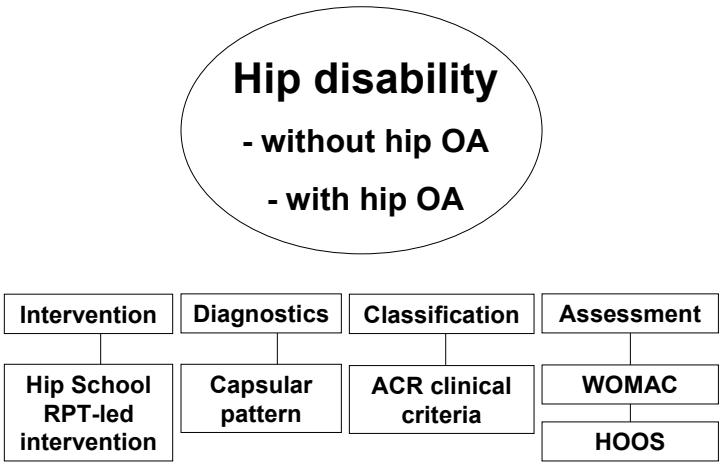


**Figure 1.** The main concepts of this thesis. Classifying, with American College of Rheumatology (ACR) clinical criteria, and diagnosing, hip osteoarthritis (OA) is the interest in papers III and IV, and patient education led by registered physiotherapists (RPT) in paper II. Papers I and V concern the development of questionnaires assessing self-rated hip problems, the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and the Hip disability and osteoarthritis outcome score (HOOS).

### *Hip disability*

Hip disability is defined according to International Classification of Functioning, Disability and Health (ICF) as impairments of body functions and/or structures, activity limitations; difficulties an individual may have in executing activities and/or participation restrictions; problems an individual may experience in life situations (Figure 2) (WHO 2001). In this thesis, the definition applies *when all other diagnostic entities than possible hip OA are excluded*.

Hip OA can be defined as a destabilisation of the normal coupling of degradation and synthesis of articular cartilage chondrocytes, extracellular matrix and subchondral bone (Tanaka et al. 1998). But both hip disability and hip OA are difficult to define and in reality impossible to separate: they are two different perspectives of a person's hip problems (Figure 3). Different questions and diagnostic modalities identify different populations. Only a fairly small group is identified by all or most definitions.

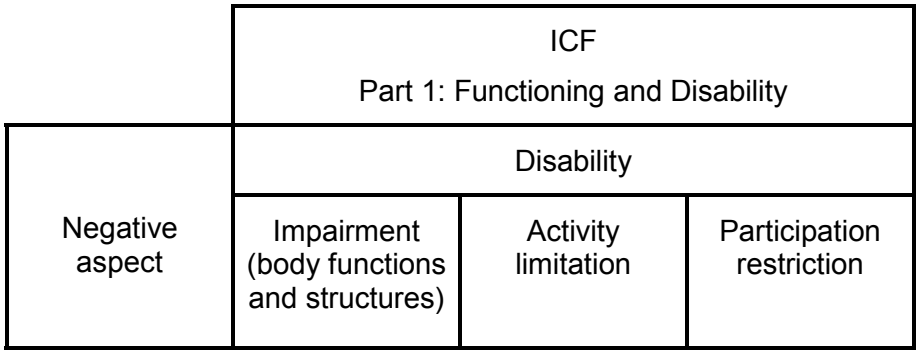


**Figure 2.** Overview of the part of the World Health Organization International Classification of Functioning, Disability and Health (ICF) of special interest in this thesis.

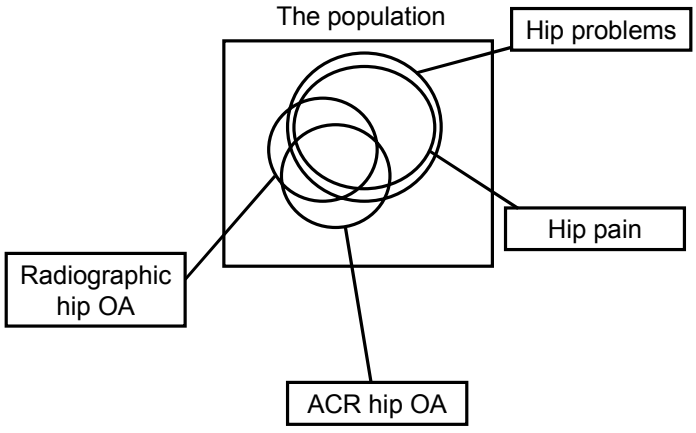


**Figure 3.** Venn diagram (not proportional) showing the different parts of the population defined according to different criteria for pain, problems and osteoarthritis (OA): radiographically or following the American College of Rheumatology (ACR) clinical classification criteria.

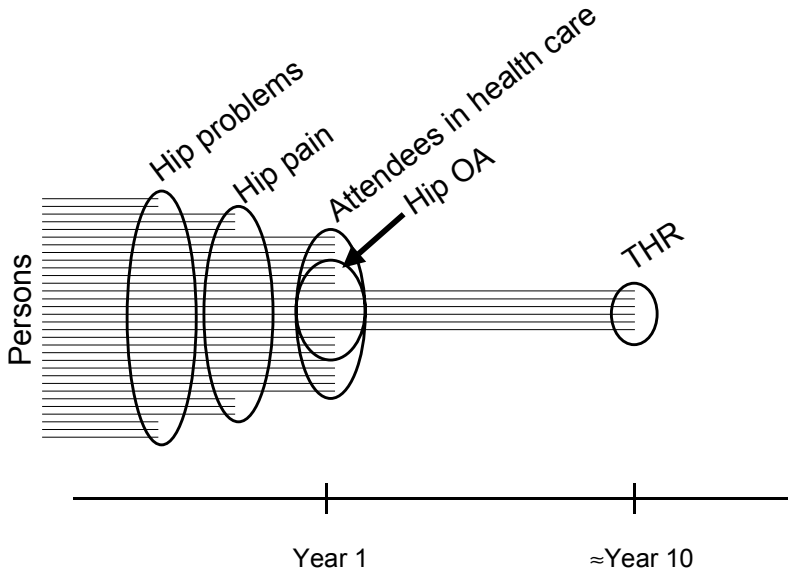


**Figure 4.** Different parts of the population defined according to different selection criteria when also considering changes over time. Not only hip problems and pain can disappear: osteoarthritic (OA) changes can, too. Only a minority, ≈1.5% aged 35-85 years (Frankel et al. 1999), need total hip replacement (THR) after an unknown number of years.

Also change over time must be considered. Pain in hip OA can lessen or disappear at times. Further, radiological OA changes can reverse (Caplan et al. 1997, Tanaka et al. 1998). Year 1 and year 10 will produce different sub-groups (Figure 4). Even severe hip OA can in rare cases, probably < 5%, undergo spontaneous recovery (Perry et al. 1972).

Hip OA is obviously of great importance. It is ranked as the fourth most important condition in women and the eighth most important in men (Murray and Lopez 1997). But it is not *one* disease or *one single condition* (Doherty and Dougados 2001), but is perhaps better called a disease spectrum with a series of subsets that can lead to somewhat similar clinical and pathological alterations (Hart and Spector 1995), a sort of "common pathway" (Altman 1997).

"Osteoarthritis remains an enigma; everyone recognizes it when they see it, but no-one can define it" (Dieppe 1984). It can involve the whole joint; bone, cartilage, synovium, ligaments, muscles, blood vessels (Felson et al. 2000) and the nervous system (Vilensky 1998) including the brain, our central scrutinising centre (Gifford 1998). Maybe the changes in the nervous system come early or even first (Wyke 1967) with consequences e.g. revealed to the trained eye in walking (Olsson 1986), consequences that have been used in assessment systems (Danielsson 1964, van Baar et al. 1998). Last but not least, the condition leads to social and personal consequences (Carr 1999).

Ways of defining hip OA differ, then, and this makes it is difficult to compare studies concerning e.g. aetiology, prevalence and prognosis. Factors that affect knee joints may not affect hip joints (Felson 1988). Factors involved in initiating pathological processes are maybe not the same as those which drive them negatively. Factors negative for the perceptible processes, the symptoms, can differ from those that are negative for tissues without innervation (Felson 1988).

As OA may be viewed as the adaptive response of synovial joints to a variety of genetic, constitutional or biomechanical insults, it must always be secondary (Solomon 1984). In some

cases we think we know the triggering factor or factors and call the condition secondary hip OA. In most cases, we don't yet know, and use the term 'idiopathic hip OA'.

Idiopathic hip OA is the main concern of this thesis. Cases with known trauma, fractures, congenital malalignments, other hip-joint diseases, inflammatory joint or neuromuscular diseases, and low-back, sacroiliac or knee problems overshadowing the hip problems have been excluded.

Describing known risk factors for developing radiological hip OA is complicated. Many factors are interconnected and even when we find them we don't know how they work or why. Genetic factor are important (Ingvarsson et al. 2000, Lohghlin 2001). The prevalence increases with age (Lawrence et al. 1966, Danielsson et al. 1984). The gender distribution is often reported as equal (Pogrund et al. 1982), though some sex differences are proposed such as more asymptomatic hip OA reported in men. Hip OA is more common in Europe and North America than among South African blacks (Solomon et al. 1975), in Hong Kong (Hoaglund et al. 1973), Saudi Arabia (Ahlberg et al. 1990), and Japan (Nakamura et al. 1989). The prevalence varies between races in North America (Hoaglund et al. 1995). Maybe hip OA is most common on Island, due to genetic factors (Ingvarsson et al. 1999). Hip OA is more common in farmers (Thelin 1990, Axmacher and Lindberg 1993), ballet dancers (Andersson et al. 1989) and among soccer players (Klünder et al. 1980, Lindberg et al. 1993, Östenberg 2001). In knee OA the relationship to obesity is strong but in hip OA results conflict (Spector 1990). Persons with hip OA are heavier than others comparable. Obesity leads to more disability (Rissanen 1990) and severe symptomatic hip OA requiring hospital care (THR) (Vingård et al. 1991). Other risk factors for severe symptomatic hip OA resulting in hospital care are heavy physical work load, occupation and former sports activity (Vingård et al. 1991, Vingård et al. 1991, Vingård et al. 1993). The association with occupation is unclear (Felson 1988). Other risk factors discussed include bone density, hormonal state and nutritional factors (Felson et al. 2000). Lindberg and Danielsson found no difference in hip OA between shipyard labourers and white-collar workers.

*Prognosis of hip OA*. So far, only three reviews have been published on the prognosis of hip OA (Felson 1993, Hochberg 1996 and Lievense et al. 2002). Few studies have followed persons with hip OA over years. Danielsson (1964) found that the majority of 119 non-operated persons with hip OA had less pain on a pain index after 10 years (Figure 5).

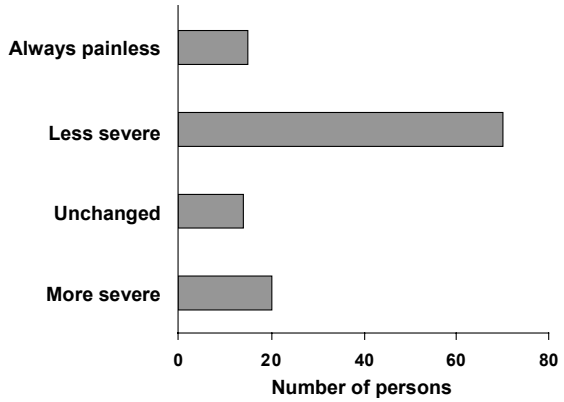


**Figure 5.** Change in pain in 119 non-operated persons with hip osteoarthritis (OA) after 10 years.

*Treatment of OA.* Both the ACR (Altman et al. 2000) and the European League of Associations of Rheumatology (EULAR) (Pendleton et al. 2000) have published recommendations for the medical management of OA with non-pharmacological modalities, including patient education, coming first. These guidelines have had little impact (Bierma-Zeinstra et al. 2000). Patients were, contrary to the recommendations, infrequently referred to physiotherapy and received non-steroidal anti-inflammatory drugs more often than paracetamol. To address this problem Dieppe (2001) has proposed a move from protocols and guidelines to statements of principle and toolboxes. For persistent pain not substantially relieved by an extended course of non-surgical (medical) management, THR is the treatment of choice (Charnley 1979). In Sweden the incidence of primary THR between 1982 and 1996 has been estimated to 209/100,000 persons/year, for persons > 49 years (Ingvarsson et al. 1999). THR is unquestionably cost-effective (Garellick et al. 1997) but the result after revision is not as good as after primary THR. Loosening of the prosthesis is the main reason for revision ad happens more often to younger persons and more often to younger men (Malchau et al. 1993).

In the initial phase of the work reported in this thesis, hip dysfunction (Paris 1985) was the central concept. Lacking established diagnostic tests or clinical criteria (Altman et al. 1991, McAlindon and Dieppe 1989, Altman 1997), hip dysfunction was defined as *pain in the hip region lasting over three months, and manifestations of impaired hip joint range of motion (ROM) and/or muscle function. Low-back, sacroiliac or knee problems should not overshadow the hip problems.* When the WHO published their classification system ICF (WHO 2001) the concept hip dysfunction, in this thesis, was changed to hip disability.

The ICF belongs to a "family" of international classifications. Health conditions (diseases, disorders, injuries, etc.) are classified primarily in the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) (WHO 1992-1994). A classification of diseases is a system of categories to which morbid entities are assigned according to established criteria. In the ICD-10 perspective, hip disability comes mainly under 'Diseases of the musculoskeletal system and connective tissue'. In the 'Arthrosis' block, distinctions are made between unilateral and bilateral coxarthrosis and between primary coxarthrosis and coxarthrosis resulting from dysplasia, post-traumatic or other secondary coxarthrosis. Finally there is a category with coxarthrosis unspecified. There is also a section with soft-tissue disorders, subdivided into disorders of muscles, synovium and tendon, and other soft tissue disorders. No diagnostic criteria are specified.

Both the ICF and ICD-10 classification systems can be used to supplement each other and to study human hip problems, of central interest here. The ICF classifies hip disability without taking account of the sometimes diagnosable underlying morbid entity, mainly hip OA, while in the ICD-10 where the diagnosis hip OA is possible if it is considered as a radiological diagnosis with no symptoms other than the abnormal joint space observed by a radiologist on X ray (Jörring 1980). Radiographic changes do not correlate well with symptoms, but they predispose symptoms (Lawrence et al. 1966).

Work has been started to link specific conditions or diseases to salient ICF domains of functioning and to list condition-specific "core" sets to be rated for every patient with that condition (Stucki et al. 2002).

## Hip pain

Pain is the cardinal symptom in hip disability both for persons with and without hip OA (Doherty and Dougados 2001). Current pain is the best predictor of subsequent pain and subsequent disability (Kazis et al. 1983). Pain is difficult to communicate both as to its amount and its nature (Ljunggren 1989). The pain language used by persons with OA is distinguishable from that used by those with fibromyalgia and/or rheumatoid arthritis (Nolli et al. 1988).

*Prevalence and location.* Many population studies have established the prevalence of long-lasting hip pain by asking for pain in a certain region of the body. Andersson et al. (1993) found a prevalence of pain in the hip / thigh in 9.8% of men and in 14.3% of women. Maybe use of this defined location leads to underestimation of true hip pain. One study tried to analyse the actually location of pain in persons with 102 hips with primary hip OA (Wroblewski 1978). Persons reported pain in the greater trochanteric area in 70% of the hips, another 70% in the knee area (none with clinical evidence of local knee problems), 62% in the front of the thigh, 46% in the groin, 39% in the shin and another 39% in the buttock.

*Hip problems.* The question "Have you during the past six months experienced any problems with one or both of your hips?" was sent out to 2,600 persons aged between 38 and 77 (Sundén-Lundius 2002). In general, 32% of them answered 'yes'. The responders were than asked to mark whether they experienced pain, stiffness or weakness – 88%, 33% and 20% respectively answered 'yes'. In that study 100 persons (12%) considered themselves to have hip problems but no pain.

## Hip range of motion

Adequate ROM, both active and passive (PROM), in hip joints is a prerequisite for activities of daily life (Nordin and Frankel 1990). Limitations can be defined according to PROM norms based on groups of persons or, in unilateral hip involvement, by contralateral comparison. The use of the latter has been questioned, not only in bilaterally affected cases but also in unilateral (Miller 1985). PROM values vary among individuals depending on such factors as age, gender (Allander et al. 1974, Svenningsen et al. 1989), activity e.g. squatting (Hoaglund et al. 1973) and measurement technique. Greene and Heckman (1994) refrained from presenting PROM norms. Instead they reported mean values with standard deviations from three studies, by Boone and Azen (1979), Roach and Miles (1991), and Roaas and Andersson (1982). According to Lea and Gerhardt (1995) reliable measurements should comprise a single method for measurement, a single system for documentation, standardized instrumentation and standardised techniques. It is easier to perform exact measurements with two testers performing the measurements together than with one only (Holm et al. 2000).

Flexibility can be defined as the maximal joint ROM (Magnusson 1998). Flexibility is an important element of fitness, and stretching of human skeletal muscle to improve flexibility is widespread. Stretching exercises to increase flexibility have been associated with improved performance, decreased muscle soreness after training, and increased joint ROM (Wiktorsson Moller et al. 1983). The effectiveness of different stretching techniques can probably be attributed to an improved stretch tolerance, at least in the short term, rather than to change in the passive viscoelastic properties of the muscle (Magnusson 1998).

## Diagnosed hip osteoarthritis

Hip OA is not the same as *diagnosed* hip OA. Physicians diagnose; but there are various diagnostic criteria for hip OA. Diagnosing by radiograph is the most common method. The

technique differs, together with the evaluation process and classification system used (Danielsson et al. 1966). There are also variations both between observers and within the same observer (Hirsch et al. 1998). Most clinical signs and symptoms are unrelated to the degree of radiographic change (Birrell et al. 2000). Despite this, radiographically defined features of OA are the most consistent ones and reflect the general idea of what is meant by the term OA (Petersson 1997). One study reported arthroscopic findings in the initial stage of hip OA (Santori and Villar 1999). Among 186 arthroscopic procedures, in radiographically normal hips with at least 6 months of hip symptoms, these authors found arthroscopically assessed hip OA in 32%. Arthroscopic examinations are invasive, expensive, and of low availability. For the hip, the technique is no longer impossible, but still complicated and the indications are questionable (Parisien 1998).

All persons with hip problems do not seek medical help. There are both predisposing factors; demography including social class, ethnicity and social structures and barriers; high prevalence of negative attitudes to OA, available treatment and previous messages from the medical profession that 'nothing can be done' that influence whether a person seeks help or not (Peat et al. 2001).

In patients newly presenting with hip pain in primary care (Birrell et al. 2000), radiographic hip OA was found in nearly half of all painful joints. In another study (Wilson et al. 1990) the age- and sex-adjusted incidence of radiographic hip OA was 47.3 per 100,000 person-years.

In the present thesis hip OA is operationally defined as a radiological diagnosis when joint space narrowing has been identified on X ray by a radiologist.

Alterations in ROM of the hip joint have, over the years, been used to establish the medical diagnosis of hip OA. In 1982 Cyriax stated that 'Arthritis is present when the capsular pattern is found'[(p11)]. He describes the capsular pattern for the hip joint: 'Gross limitation of flexion, abduction, and medial (present authors' comment: *internal*) rotation. Slight limitation of extension. Little or no limitation of lateral (present authors' comment: *external*) rotation'[(p56)]. In very early arthrosis, 'medial (present authors' comment: *internal*) rotation is the first movement to become measurably restricted; slight limitation of flexion soon follows'[(p382)].

Back in the 1950s, Kaltenborn began developing a physiotherapy specialty related to orthopaedic medicine, Orthopaedic Manipulative Therapy. For Kaltenborn as a physiotherapist, the main purpose of patient examination is to reveal joint dysfunction as a basis for planning physiotherapy. In the latest edition of his book 'Manual Mobilization of the Joints' (1999), Kaltenborn writes 'limitation of movement due to capsular shortening does not necessarily follow a typical pattern'[(p34-35)]. But he lists the capsular pattern of the hip: internal rotation – extension – abduction – external rotation[(p261)]. Thus there are discrepancies between the hip capsular patterns as listed by Cyriax and by Kaltenborn. As far as know, neither confirms the order or the ability to indicate whether arthritis is present.

Since OA lacks established diagnostic features (Altman 1991) the ACR has developed clinical classification criteria for hip pain associated with hip OA (Altman et al. 1991). The criteria are not intended for use in individual diagnosis but for selecting clinical, laboratory,

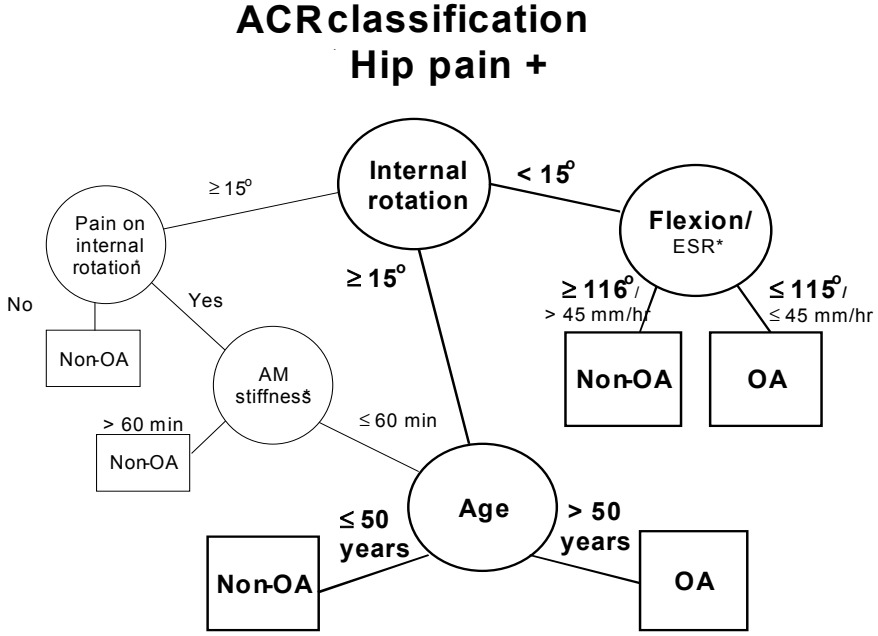


**Figure 6.** The working version of the American College of Rheumatology (ACR) clinical criteria classifying hip pain associated with hip osteoarthritis (OA) used in paper IV. Data for variables marked with an asterisk (*), pain on internal rotation, morning (AM) stiffness and erythrocyte sedimentation rate (ESR), are not available in this working version.

and/or radiological features to identify groups of patients with symptomatic hip OA, in order to separate this condition from other diseases associated with joint symptoms and to promote uniformity in the reporting of OA. The ACR ended up with two different clinical classification criteria, one with clinical variables only (Figure 6) and one with combined clinical and radiological variables (Altman et al.1991). Both are widely used.

The ACR clinical criteria contain two ROM variables: internal rotation and flexion, but do not mention whether this refers to active or passive ROM; neither do they recommend what measurement technique to use (Altman et al. 1991).

### *Patient education*

Patient education can be conceived of as an ongoing process of self-management and patient care designed to attain the best possible outcomes where the generalised expert, in this case the physiotherapist, collaborates with the individual expert, the patient. Patient education is proposed in the recommendations for the medical management of OA both by the ACR (Altman et al. 2000) and EULAR (Pendleton et al. 2000).

Many educational interventions have focused on patients with rheumatoid arthritis (Hirano et al. 1987) or spinal disorders (Keijser et al. 1992). Few studies have been published concerning educational interventions solely targeting people with OA. A literature review concerning education of patients with arthritis, including OA, concluded that improvement of arthritis symptoms by 15-30% is attainable through patient education (Hirano et al. 1994). A meta-analysis showed that patient education provides on average 20% more pain relief than non-steroidal anti-inflammatory drugs alone do (Superio-Cabuslay et al. 1996).

One developer of patient education in arthritis is Lorig (Lorig 1986). Some 15 years ago she found no association between the changes in health status seen and assessed behaviour (Lorig et al. 1989); instead she observed associations with psychological changes. Theories such as self-efficacy, stress and coping, learned helplessness and social support were proposed to help in the development of educational interventions (Gonzalez et al. 1990). Bandura's self-efficacy theory (Bandura 1977) have proved useful for explaining psychological changes brought about by patient education (Allegrante et al. 1993), by exercise (Marcus 1994, Rejeski 1998) and for predicting health behaviour change (Strecher 1986). The concept of coping with long-standing pain (Lazarus and Folkman 1984) has developed into a complex research area and training in pain coping skills can lower levels of pain and disability (Keefe 1990). Patient education can be a way to find health, a salutogenic tool (Antonovsky 1987). Antonovsky's concept sense of coherence (SOC) including comprehensibility, manageability and meaningfulness, has been found to be associated with successful coping with different stressors and the adoption of more health-related behaviours (Larsson et al. 1994).

There is in Swedish physiotherapy a long tradition of working with patient education in schools, starting with the Back School (Bergquist-Ullman 1978) followed by Schools for other patient groups (Ringsberg et al. 1990, Kamwendo 1991).

### Hip School

A Hip school, combining individual sessions and group meetings and led by physiotherapists, has been developed. This was done through literature reviews, reflection-in-action, interviews with physicians, systematic collection of patients' questions – what they want to know. Answers were developed with illustrations and photos for presentation on slides. The Hip School is run as one individual start-up session, three group meetings and one individual follow-up session after approximately 2 months. The latter is an integral part of the Hip School because social support improves functional status (Weinberger et al. 1986, René et al. 1992) and is cost-effective (Weinberger 1993). Appendix I in paper II contains a brief summary of the Hip School.

*Literature reviews* have been conducted covering different topics from the first encounter (Westman Kumlin and Kroksmark 1992) to biomechanics (Nordin and Frankel 1989).

*Reflection-in-action.* Work in the same small community of 17,000 inhabitants, for a number of years, affords one the opportunity to actually work together with persons with hip problems. Several studies have been performed with former patients. The Hip School and this thesis are the result of (sometimes) systematic, critical enquiry, problem solving, clinical reasoning and the struggle to become a reflecting practitioner (Schön 1991, Donaghy and Morss 2000).

*Interviews with physicians*. The contents of different practice patterns were surveyed and described. That study (Klässbo 1993) included the nature of the underlying disease causing symptoms, diagnostic procedures, physicians' treatment strategies and course for patients with hip OA. In-depth, unstructured interviews were made and taped with 14 strategically selected physicians. Transcription, labelling and content comparison of domains followed. A short story line was condensed allowing the construction of two main disparate practice patterns: 1) the cartilage-oriented, wear-and-tear model – with progression and prescription of drugs while awaiting THR; and 2) the joint-oriented, changeable-process model – with different possible courses even regression, physical activity and exercise, permitting postponement of THR.

Conclusions from that study were that different practice patterns, more or less verbalised and reflected over, can contain perceptions about the nature of the underlying disease-causing symptoms, diagnostic procedures and treatment strategies. To verbalise through interviews can change the practice pattern both for the interviewer and the interviewed. It is proposed here that a subject-oriented, changeable-process model with – at least in the early and/or favourable stages – hip dysfunction with or without known hip OA as the area of interest. This should replace the wear-and-tear model and the negatively interpreted terms 'worn-and-torn' or 'worn-out' joint.

*Patients' questions*. Over the years, the questions Hip School participants have asked, at their first group meeting have been collected. This is for three reasons: first for use in plan every individual Hip School round, secondly to check whether the questions have been answered by the end of each School round; and finally to check the contents and the film slides to discover new areas. Whether or not to eat glucosamine is one such a new area to be addressed.

*Illustrations and photos*. The Hip School now uses 113 slides, with photos, text and illustrations. Much emphasis has been put on the latter, and five professional illustrators have been employed. An example is the hip monster on the cover of this thesis. After the Hip School, he realises that with hip disability much must be "lagom" – not-too-little, not-too-much-but-just-right – and then he loses some of his monstrous appearance. Ursula Wilby, Sweden, did these illustrations.

The simple 'wear-and-tear model' with focus on cartilage, with a worn-out joint as the final common pathway, elicits 'low-use behaviour' where certain activities are avoided. The person becomes physically inactive and deteriorates. Emotions such as fear and sadness, according to Lazarus (1991), lead further to avoidance and inactivity, respectively.

Instead of this 'wear-and-tear model' the Hip School presents OA as an active process with healing and remodelling, mostly insensibly. The process can be influenced, in both positive and negative directions. Some of these processes change the way we move or what we experience. Loading is necessary (Palmoski et al. 1980).

Exercise is one of the roots of physiotherapy (Lamb and Frost 1993) and of the Hip School. Exercises should be task-specific i.e. train the things that most people with hip disability find problematical in daily life. The training, called self-help hints, should be done on a daily basis but not be time-consuming. Strategies are used to facilitate the behavioural change proposed in the self-help hints. If behavioural changes in daily life are the most important thing – start with such changes and not with ultrasound or interferential treatment. The physiotherapist as the 'generalist expert', show in your doings what you think is most important. If change is the person's own responsibility and you trust that person, then you must show that you do. When showing an exercise, show not only how but, just as important, why. In health care we often have problems in giving our patients reasons for what we ask them to do (Sim 1990). Finally, if standing up every 20 minutes is important you must do this in the three Hip School group meetings.

## Main self-help hints

1. Daily range-of-motion exercises

The participants in the Hip School receive a self-training programme for keeping up or improving flexibility (Magnusson 1998). The exercises are *relaxation despite pain*, for 30 seconds *only once a day*, at the end-point of motion in six combined directions in sitting, lying and standing. Comparison can be made with daily tooth-brushing. Results can be expected in 4-5 weeks. Lying prone for 20 minutes a day, starting with smaller portions, are also recommended.

2. "Lagom" physical activity

A key concept of the Hip School is to try to stay as fit as possible in spite of pain. Nothing is forbidden, so long as it is "lagom". "Lagom" is a Swedish word meaning not too much and not to little. Activities with pain and activities with ensuing pain are not prohibited. Activities that leads to more pain the day after are not recommended (Thomeé 1997). When there is more pain the day after an activity one has been borrowing from tomorrow, and borrowers must always pay interest. For activities that often give more pain the day after, you have to borrow just to pay the interest. This is a metaphor for helping patients to find the appropriate physical stress for enhancing stress tolerance (Mueller and Maluf 2002) without negative over-loading. Physical activity for at least an aggregate of 30 minutes a day is a recommendation for both health and physical fitness (Minor 1999). The "low-use behaviour" so common among OA patients, give less physical activity and higher body mass index (BMI), two well-known risk factors for increased morbidity and mortality (Ries et al. 1996, Christmas et al. 2002).

3. Don't sit for more than 20 minutes at a time

Participants are recommended not to sit for more than 20 minutes at a time, then to stand up and sit down again. The cartilage requires regular compression and decompression for adequate nutrition and stimulation for remodelling and repairs (Bland and Cooper 1984). As an extra bonus, the stiffness is less when you don't sit too long!

4. Body awareness training

Body awareness techniques inspired by the principles of T'ai-chi (Hartman et al. 2000) but simpler and easier to learn are trained. Exercises focusing on the ability to trust the ground to carry one's weight equally on both legs and with full hip extension were performed once. The overarching aim of this part of the Hip School is to increase sensory-motor awareness, perception of dysfunctional movement patterns and habits. It also seeks to increase locomotor control, by increasing grounding and stability in the centre-line.

5. Relaxation training

Relaxation training is not actually included in the Hip School, but is proposed as a coping skill to be practised and applied in daily life. Different techniques are named and active movements (see under 4. above) and sometimes hands-on techniques such as massaging, and massaging combined with the exercises at the end-point of motion (see under 1. Above), as well as other sensory techniques (hot and cold packs) are proposed.

In the Hip School an overview of available pharmacological, non-pharmacological and surgical treatments is also given, with pros and cons (Altman et al. 2000, Pendleton et al. 2000). Participants are encouraged to seek medical help when their own struggles are not enough.

### *Assessment*

Outcome measurements in OA trials have mostly been based on clinical and/or radiographic examinations. Most score systems have been developed and used by surgeons, and show different results in the same patient (Andersson 1972, Liang et al. 1990). Pain, limitations of ROM and restriction of function, including walking ability, constitute common clinical assessment tools (Danielsson 1964, Wykman and Olsson 1992). Another way of measuring walking ability is the six-minute walk (Guyatt 1985) but this has not been validated or tested for reliability in hip OA. The patients' perceptions have seldom been assessed (Kelley 1991) and when they have there are differences between patients' and physicians' evaluations – especially when the patient is not satisfied with the outcome (Lieberman et al. 1996).

In 1981, Professor Bellamy conducted his first study to create, for this research area, a totally new outcome instrument. The patients were not only allowed to add items to the scoring system, but they were also their own outcome measurers: a patient-centred outcome measure was taking shape. The need for such an instrument arose from a literature review (Bellamy and Buchanan 1984) showing great variability, and in many cases questionable quality, in the methods of measuring outcomes in clinical OA trials. To develop the new instrument, four rheumatologists and two epidemiologists experienced in the clinical measurement of rheumatic diseases formulated the items, while patients were asked to add pain and physical disability items (Bellamy and Buchanan 1986). To assess content validity, the patients were asked to rate the importance of each item. It was thus that, after validation studies, the WOMAC was established (Bellamy et al. 1988, Bellamy et al. 1988).

Now widely used, the WOMAC is one of two instruments recommended by the Osteoarthritis Research Society International for use in clinical trials in people with hip OA (Altman et al. 1996). The other is the Lequesne Index (Lequesne 1987). The utility and measurement properties of the WOMAC, reported from different populations and types of intervention, have been reviewed (McConnel et al. 2001). These authors concluded that large effect sizes had been found when assessing the results after total hip replacement (THR); however, experience of use for populations with hip disability with or without hip OA is scarce; as is that of evaluations of early-treatment strategies.

In the original Likert version, Bellamy summed the actual item scores 0-4 to a sub-scale score with different ranges depending on different numbers of items in the three sub-scales. The pain sub-scale has five items (possible range 0-20), the stiffness has two items (range 0-8) and activity limitations has 17 items (range 0-68). To compare different sub-scale scores and sub-scale scores in the similar questionnaires Knee injury and Osteoarthritis Outcome Score (KOOS) (Roos et al. 1998) and Foot and Ankle Outcome Score (FAOS) (Roos et al. 2001) – see below – the sub-scales scores can be transformed to 0-100 best-to-worst or, following Roos and others, to 100-0.

To achieve an instrument better able to evaluate patient-relevant outcome in patients with knee injury and post-traumatic knee OA, Roos developed an extension of the WOMAC with 18 new items and two more sub-scales. She ended up with an instrument, the KOOS, with better responsiveness than the knee version of the WOMAC (Roos et al. 1998).

The Functional Assessment System (FAS) for assessing functional status in the lower extremities (Öberg 1994) has been used in several studies of hip disability (Thourup 1995) and for evaluating the results after THR (Nilsdotter 2001, Eriksson 2002).

## Aims

The aims of the work reported in this thesis were to:

- improve the assessment of self-rated hip problems by reporting the measurement qualities of a Swedish version of the WOMAC (available in both knee and hip formats) (**paper I**)
- assess the effects of a patient-educating "Hip School" developed by the present author and led by physiotherapists, in terms of reduction of self-rated hip problems and of improved health-related quality of life (**paper II**)
- examine hip PROM in six directions and arrange and describe PROM patterns based on extent of limitation, if any, in absolute degrees, compared to three PROM norms
- count the number of hips presenting capsular patterns according to both Cyriax and Kaltenborn (**paper III**)
- validate the ACR clinical criteria for classifying patients with hip pain associated with hip OA, with radiologically diagnosed hip OA as "gold standard" (**paper IV**)
- further improve the ability to detect clinically important change over time for assessing hip disability in early stages and for persons without hip OA by adding items and sub-scales to the WOMAC in the HOOS (**paper V**)

## Subjects

The five papers in this thesis are based on three studies (Figure 7).

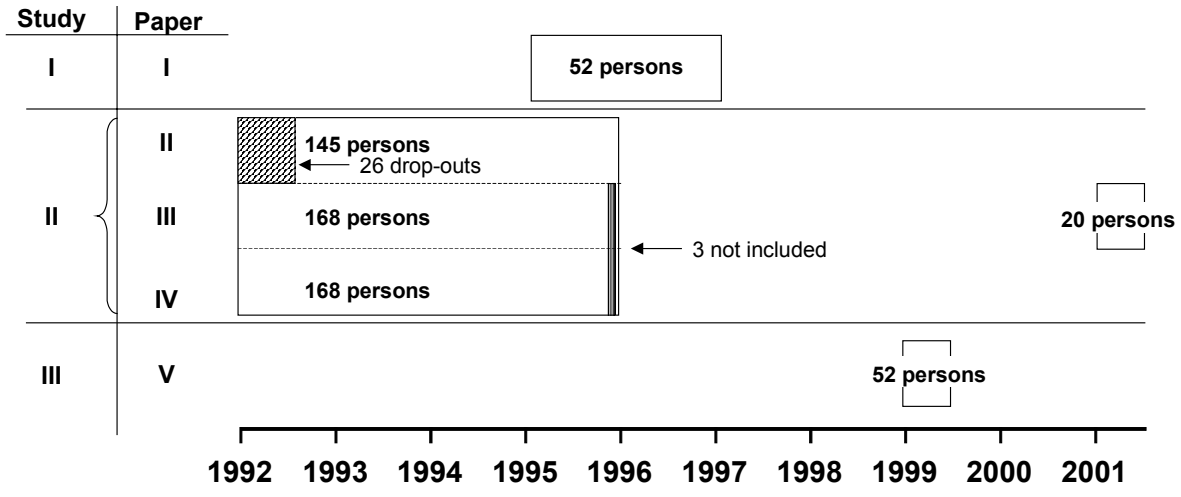


**Figure 7.** The relationships between present studies, subjects and corresponding papers.

**Table 1.** Subjects included in papers I to V.

| | Paper | | | |
|---|---|---|---|---|
| **Subjects** | **I** | **II** | **III and IV** | **V** |
| *n* | 52 | 145 | 168 | 52 |
| Mainly knee problems | • | | | |
| Mainly hip problems | | • | • | • |
| Former Hip School attenders | | | | • |
| OA (number of persons) | | | | |
| - Non-OA/unilat OA/ bilat OA | -/52[a]/- | 44/65/34[b,c] | 50/77/41[c] | 13/16/23[c] |
| Age (years) | | | | |
| - Mean | - | 62 | 62 | 63 |
| - SD | - | 10.3 | 11.0 | 9.1 |
| - Median | 48 | 61 | 61 | 64 |
| - Range | 20-69 | 36-87 | 36-90 | 42-84 |
| Sex (male/female) | 27/25 | 59/86 | 71/97 | 17/35 |
| BMI (kg x $m^{-2}$) | | | | - |
| - Mean | - | 27 | 27 | |
| - SD | - | 3.5 | 3.5 | |
| - Median | 26 | 27 | 27 | |
| - Range | 21-36 | 19-37 | 19-37 | |
| THR (number of persons) | - | - | - | |
| - THR unilat/bilat | | | | 7/1 |
| - waiting list THR | | | | 4 |

OA: osteoarthritis, SD: standard deviations, BMI: body mass index, THR: total hip replacement

### *Paper I*

Paper I is based on study I with 200 consecutive patients on the waiting list for knee arthroscopy at the Department of Orthopaedics at Lund University Hospital, Sweden. Inclusion criteria were (a) cartilage damage of the tibiofemoral joint as seen on arthroscopy and (b) ability to complete questionnaires in Swedish (*n* = 55). Exclusion criteria were involvement of other joints affecting lower-extremity or back function (*n* = 3). Preoperative data were available for these 52 patients (Table 1).

### *Papers II, III and IV*

Study II comprises 171 patients with hip disability whom physicians in primary care and orthopaedic units consecutively recruited. The inclusion criterion was hip disability which, lacking established diagnostic tests or clinical criteria (Altman et al. 1991, McAlindon and Dieppe 1989, Altman 1997), we defined as *pain in the hip region lasting over three months, and manifestations of impaired hip joint ROM and/or muscle function*. All the subjects had been radiologically examined, although radiological evidence of hip OA was not required for inclusion. The physician's inclusion form enumerated the following exclusion criteria: *trauma, fractures, congenital malalignments, other hip joint diseases, inflammatory joint or neuromuscular diseases, and low-back, sacroiliac or knee problems overshadowing the hip problems*. Further, for inclusion, the subjects should not be listed for or meet the inclusion criterion for THR defined as: *severe pain and persisting resting pain despite pharmacological treatment, all other kinds of pain treatment tried, disturbed night sleep, and walking ability not exceeding 2-300 m, even with walking aid*.

### Paper II

Paper II comprised all 171 patients in study II. They were assigned to a treatment group or a control group according to residential area. In addition to the above-mentioned inclusion and exclusion criteria the control group was not permitted physiotherapy treatment six months before or during the study, nor previous participation in a "Hip School".

*Dropouts.* In the treatment group 17 persons dropped out after the initial test, six due to THR, while 11 declined or did not show up. In the control group nine persons dropped out. Five did not want to wait for physiotherapy treatment and four declined or did not show up. Finally, the sample comprised 145 persons, 77 in the treatment group and 68 in the control group (Figure 7 and Table 1).

### Paper III and IV

Paper III and IV comprised 168 patients of the 171 in study I (Figure 7 and Table 1). Two persons that were included in paper II and one of the drop-outs in paper II were in these two papers excluded due to the fact that we were unable to get their radiological reports. All other dropouts in paper II were included in papers III and IV because data were used only from the first test occasion. When comparing the subjects with radiological evidence of hip OA ($n$ = 118) and the persons with no hip OA ($n$ = 50) there were differences in both age and sex distribution with older age in the OA group and more males (Table 2).

Study II comprised an additional test-retest study of the PROM testing ($n$ = 20) used mainly in paper III (Figure 7). Fourteen subjects had the same inclusion and exclusion criteria as in the original study and six others had no reported neuromusculoskeletal dysfunction in the knee or hip (10 male/10 female, mean age 58.8 (SD 8.9)).

**Table 2.** Comparison between age, Body Mass Index and sex for the osteoarthritis (OA) ($n$ = 118) and non-OA groups ($n$ = 50) in study II. The comparisons are also important for analyses of results, papers III and IV.

| | | **OA** | **non OA** | ***t*-value[a)]** | ***p*-value** |
|---|---|---|---|---|---|
| Age (years) | mean (SD) | 63.0 (11.0) | 58.6 (10.5) | | |
| | range | 36 - 90 | 36 – 82 | -2.40 | 0.02 |
| BMI (kg/m$^2$) | mean (SD) | 27.2[b)] (3.5) | 27.0 (3.4) | | |
| | range | 19.4 -36.5 | 20.8 - 33.4 | -0.32 | 0.75 |
| | | **Freq % (*n*)** | **Freq % (*n*)** | **Chi-square[c)]** | ***p*-value** |
| Male | | 34 (57) | 8 (14) | | |
| Female | | 36 (61) | 22 (36) | 5.93 | 0.02 |

[a)] *t* test used for age and BMI, [b)] One person missing, [c)] Chi-square test used for gender, SD: standard deviation

### *Paper V*

Study III was conducted with 91 of 250 patients registered at the "Hip School" at the Department of Physiotherapy at Säffle Hospital between 1989 and 1994 and included in a previous study (Thorup 1995). There, they were matched according to sex, employment/pension, pain and activity limitations in three treatment groups ($n$ = 69). They met the following inclusion criteria: a) living in the catchment area of Säffle Hospital, b) no hip surgery, c) no other severe diseases and d) hip pain with no other known diagnosis than clinical hip OA causing the hip pain. Radiological signs of hip OA were not required (O'Reilly and Doherty 1998). On inclusion, all subjects were examined radiographically.

These 69 subjects were contacted in 1999. However, fourteen were deceased, refused, could not be traced, had other serious diseases or had changed diagnosis. Thus fifty-five subjects were included. Three did not fill in the questionnaires on both test occasions, or did not rate the importance of the items, and so were excluded. The median age of the remaining 52 subjects (35 females), was 64 years (range 42 to 84) (Figure 7 Table 1), and 24 were under 64 years.

## Methods

Table 3 overviews the levels according to the ICF and the corresponding measurements used.

**Table 3.** Levels of assessment according to the components of the negative aspect of the International Classification of Functioning, Disability and Health (ICF), for the measurements used in the different papers in this thesis.

| Measurements | Impairments | Activity limitations | Participation restrictions |
|---|---|---|---|
| Arthroscopy | I | | |
| ACR clinical criteria | IV | | |
| HOOS (including WOMAC) | | V | V |
| Nottingham Health Profile | | II | II |
| Passive range of motion | III, IV | | |
| Radiographs | I – V | | |
| Short Form-36 Health Survey | | I | I |
| WOMAC | | I, II, V | I, II, V |

ACR: American College of Rheumatology, HOOS: Hip disability and osteoarthritis outcome score, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index

### *Questionnaires*

#### The Western Ontario and McMaster Universities Osteoarthritis Index – WOMAC

The original Likert version 3.0 with 5 Likert boxes, was translated into Swedish in two separate processes by the two first authors in paper I. Linguistic validation was carried out in four steps: translation, back-translation, committee review and pre-testing according to published guidelines (Jones 1987) described in paper I.

To permit comparison across sub-scales, the summed raw scores were transformed to a 0 - 100 scale (Stucki et al. 1996). To further simplify comparison with other common orthopaedic scales, this transformation was, in paper I, changed to 100 - 0 scale, where 100 indicates no pain, stiffness or activity limitation, and 0 extreme pain etc (Roos 1999).

### Hip disability and osteoarthritis outcome score – HOOS

The objective of paper V was to develop a patient-relevant outcome measure for patients with hip disability with or without hip OA. It was decided at the outset of the study that all the items from the Swedish version of the WOMAC LK 3.0 (paper I) should be included in its original form in the new questionnaire, to permit calculation of both instruments.

*KOOS.* The 18 items added to the WOMAC in the Knee injury and knee Osteoarthritis Outcome Score (KOOS) (Roos et al. 1998) were used and tested with the word 'knee' changed to 'hip'.

*Additional items.* Using over one hundred interviews with patients with hip disability with or without hip OA, the first author in paper V (MK) constructed five items concerning pain and ROM demanding activities that could also be experienced in mild hip disability.

The time frame was 'last week'. Five Likert boxes were used (no, mild, moderate, severe, extreme or the equivalent, depending on question) scored from 0 to 4. To permit comparison across sub-scales both within and between instruments, the summed raw scores were transformed to a 0-100 scale: 0 = no pain, stiffness or activity limitation; 100 = extreme pain, etc (Stucki et al. 1996).

In paper V items were selected and the resulting HOOS was established with 39 items, in five sub-scales: Pain (P), Symptoms (other, including stiffness) (S), Activity limitations - daily living (A), Activity limitations - sport and recreation (SP) and Hip-related Quality of life (Q).

### The Nottingham Health Profile – NHP

The NHP is a health-related quality-of-life instrument covering areas of emotional reaction (EM, 9 statements), sleep disturbance (SL, 5 statements), lack of energy (EN, 3 statements), pain (P, 8 statements), physical mobility (PM, 8 statements), and social isolation (SO, 5 statements) (Wiklund et al. 1988). Each item score is weighted, thus enabling the sum score in each sub-scale to range from 0 to 100, best to worst.

### Short form 36 – SF-36

The Short Form 36 item of the Medical Outcome Study (SF-36) is a generic measure of health status and comprises eight subscales: Physical Function, Role-Physical, Bodily Pain, General Health, Vitality, Social Function, Role-Emotional, and Mental Health (Ware and Sherbourne 1992). The sub-scales range from 0 to 100, 100 indicating the least health-related problems and 0 the worst health-related problems. The Swedish acute version 1.0 was used (Sullivan and Karlsson 1994).

### Global general health and global hip pain

In paper V the subjects were asked to rate their global general health and global hip pain on both test occasions: worse than usual, as usual, better than usual, according to the recommendation of the Osteoarthritis Research Society (Altman et al. 1996).

**Table 4.** Classification system for physical activity, including domestic activities, reported in paper II.

| Classification system of physical activity including domestic activities |
|---|
| 1. Hardly any physical activity. |
| 2. Mostly sitting, sometimes a walk, easy gardening or similar tasks, sometimes light household activities such as heating up food, dusting, or ”clearing away” |
| 3. Light physical exercise for about 2-4 hours a week, e.g. walks, fishing, dancing, ordinary gardening etc. including walks to and from shops. Main responsibility for light domestic work such as cooking, dusting, “clearing away”, and making beds. Performs or takes part in weekly cleaning |
| 4. Moderate exercise 1-2 hours a week, e.g. jogging, swimming, gymnastics, heavier gardening, home repair moderately easy physical activities more than 4 hours a week. Responsible for all domestic activities, easy as well as heavy. Weekly cleaning whit vacuum cleaning, washing floors and window-cleaning |
| 5. Moderate exercise at least 3 hours a week, e.g. tennis, swimming, jogging. |
| 6. Hard or very hard exercise regularly, several times a week, with great physical exertion, e.g. jogging, skiing |

### Physical activity levels

In paper II the level of physical activity including household activities was reported on a six-grade scale (Table 4) (Mattiasson-Nilo et al. 1990).

### *Range of motion*

One physiotherapist with 18 years of clinical experience of musculoskeletal disorders, who was blind to the radiological reports, conducted all PROM measurements in study II, prior to the “Hip School” intervention. To make the PROM measurements more reliable, precautions were taken according to Stratford et al. (1984) and Gajdosik and Bohannon (1987) for the examiner, the examined and the examination.

In the additional test-retest reliability study the same physiotherapist and measurement protocol was used as in the other part of study II, with 30 minutes’ sitting before and between the two tests. Intraclass correlation coefficient (ICC) varied between 0.56 and 0.92 in the six tested PROM directions, and standard error of measurement (SEM) between $2.3^{o}$ and $5.3^{o}$, with the best reproducibility for flexion, internal rotation and abduction.

The examiner used the $0\text{-}180^{o}$ notation system to the nearest whole degree. A $180^{o}$, transparent, plastic goniometer with 250 mm arms and a scale with every degree marked was used. The patients lay on a firm treatment table. PROM was measured bilaterally, once, to avoid a treatment effect. Internal and external rotation were measured with the patient prone, knees at $90^{o}$ of flexion (Greene and Heckman 1994). The supine position was used for measuring flexion, abduction, adduction, and extension. The method described by the American Academy of Orthopaedic Surgeons (AAOS) (Greene and Heckman 1994) for measuring flexion deformity was used for measuring extension in a supine position with the pelvis stabilised by the patient holding, with the hands, the opposite leg in hip and knee flexion in the position where, as determined by the examiner, the lumbar spine just starts to flatten. The patients lay somewhat diagonally on the edge of the treatment table, thus permitting full hip extension in the tested leg.

The protocol for PROM measurements included a standardised testing sequence and extremity position. The goniometer alignment for both arms with reference points was inked on bony landmarks on the skin. The landmarks used were for flexion and extension the greater trochanter and the lateral epicondyle of the femur and for abduction and adduction the midline of the patella. The method used for stretching the soft tissues at the end point of motion relied on the examiner's clinical experience (Norkin and White 1995). The examiner was trained with a balance to use a manual force corresponding to approximately 50 N (Keating et al. 1993).

### *Radiography*

In paper I weight-bearing radiographs of knees were available for 32 of the 52 patients. The radiographs were classified according to the recommendations of the Osteoarthritis Research Society (Altman et al. 1995).

In papers II, III and IV all patients underwent a radiological examination performed in several units, with no consistency regarding views or standards used. The films were interpreted by the duty radiologist following normal clinical routines. The radiological diagnosis of OA was based on the radiological report. In all but six patients, the phrase "joint space narrowing" was used in the reports. In these six patients (6 OA hips), OA was diagnosed clearly by the radiologist, but without using the phrase "joint space narrowing."

In paper V all subjects were examined radiographically in 1995. New films were taken at that time if 1) persons had never been X rayed, 2) earlier films were not available or 3) earlier films older than six months showed no radiological evidence of hip OA; otherwise old films were reviewed. One radiologist examined all the X rays. The OA diagnosis was accepted if the minimum joint space width, measured with a millimetre rule, was < 4 mm in people under 70 years, < 3 mm in people 70 years or older, or if the reduction was >1 mm as compared to the contralateral side in unilateral hip disease (Danielsson 1966).

### *Test procedures*

#### Paper I

The Swedish version of the WOMAC was mailed together with background variables preoperatively to the 52 patients meeting the inclusion and exclusion criteria. Thirty-five of these 52 patients completed the WOMAC twice within two to ten days. To assess post-operative change, the WOMAC was mailed again to the patients three months post-operatively.

#### Papers II, III and IV

*Paper II.* The treatment group was tested before entry (test 1) to the "Hip School" and after 6 months (test 2) with the tester "blind" to prior results. The same test interval applied for the control group. The treatment group was re-tested after 1 year (test 3).

*Papers III and IV.* In both these papers only data from test 1 was used.

#### Paper V

The preliminary version of the instrument, with all 24 WOMAC items, all 18 items added to the WOMAC in KOOS and all the five additional items, was mailed twice, with a one-week interval, together with the global general health and global hip pain questions.

### *Data analysis*

#### PROM patterns and test of capsular patterns - paper III

When ordering PROM directions in patterns, the most limited direction, if any, in absolute degrees, comes first, followed by the second most limited direction, and so on. An example of the method from the 10 first hips and the last one (number 336) is presented in table 5. Directions with more PROM than the norm were also ordered in the patterns, giving 720 possible combinations. Table 6 shows how the patterns were counted, here for the OA hips.

**Table 5.** Procedure for defining passive range-of-motion (PROM) patterns. Negative values correspond to PROM smaller than norms used.

| Hips | F[a] | E[b] | B[c] | D[d] | M[e] | L[f] | Patterns |
|---|---|---|---|---|---|---|---|
| nr | Degree of motion compared to normal | | | | | | |
| 1 | -6 | -5 | -23 | 22 | 2 | -19 | BLFEMD |
| 2 | -6 | -4 | -12 | 16 | 7 | -15 | LBFEMD |
| 3 | 1 | -3 | -24 | 9 | -1 | -6 | BLEMFD |
| 4 | -4 | -3 | -14 | 11 | 12 | -13 | BLFEDM |
| 5 | -10 | -2 | -6 | 18 | -1 | 0 | FBEMLD |
| 6 | -17 | -5 | -22 | 11 | -8 | -16 | BFLMED |
| 7 | 12 | -1 | -14 | 13 | -19 | -10 | MBLEFD |
| 8 | 11 | -5 | -12 | 13 | 6 | -24 | LBEMFD |
| 9 | -11 | -22 | -17 | 22 | 3 | 4 | EBFMLD |
| 10… | -11 | -19 | -14 | 12 | 7 | -10 | EBFLMD |
| 336 | 2 | 1 | -19 | 3 | -3 | -31 | LBMEFD |

[a)] F = flexion, [b)] E = extension, [c)] B = abduction, [d)] D = adduction,
[e)] M= internal rotation, [f)] L= external rotation

**Table 6.** Procedure for counting number of passive range-of-motion (PROM) patterns.

| Number of patterns | Patterns | Freq. |
|---|---|---|
| 1 | BFLMED | 6 |
| 2 | BLEMDF | 1 |
| 3 | BLFEMD | 7 |
| 4 | BLFMED | 9 |
| 5 | EBFLDM | 1 |
| 6 | EBFMLD | 1 |
| 7 | FBLEMD | 3 |
| 8 | LBEMFD | 6 |
| 9 | LBFEMD | 6 |
| 10 | LBMEFD | 7 |
| 11… | MBLFED | 2 |
| 68 | MLFBED | 1 |
| | | 159 |

[a)] F = flexion, [b)] E = extension, [c)] B = abduction, [d)] D = adduction,[e)] M = internal rotation, [f)] L = external rotation

*PROM norms.* Three different PROM norms were used for calculating limitations. The mean for the symptom-free hips (hips with non-OA and no self-reported hip pain) in our study ($n$ = 100) minus 1 SD and rounded downwards to the nearest $5^0$: flexion $110^0$, extension $5^0$, abduction $20^0$, adduction $20^0$, internal rotation $20^0$, and external rotation $25^0$ was used. Secondly, Kaltenborn's published PROM norms: flexion $130^0$, extension $15^0$, abduction $45^0$, adduction $20^0$, internal rotation $40^0$, and external rotation $45^0$ were used (Kaltenborn, 1999)[(p262)]. For the patients with unilateral hip OA ($n$ = 77), PROM in the non-OA hip was used as norm. Cyriax's proposed PROM norms could not be used due to lack of precise PROM values for flexion and extension. The number of PROM patterns, the most common patterns, and the number of hips with limitations in all six directions with the three PROM norms used, respectively, was calculated

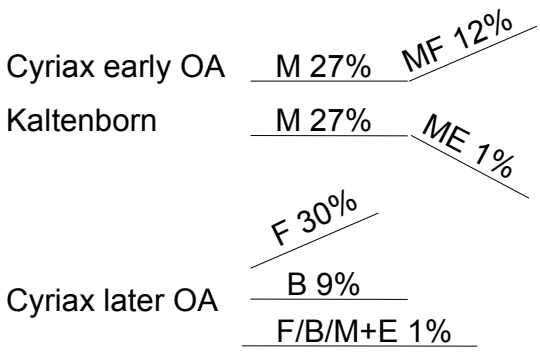


**Figure 8.** Cyriax's proposed capsular pattern in early hip OA, with most passive range-of-motion (PROM) limitation in internal rotation (M) followed by flexion (F) and (Kaltenborn) extension (E), Cyriax's 'Gross limitation of flexion, abduction (B), and medial (present authors' comment: *internal*) rotation. Slight limitation of extension. Proportions of unilateral hip OA hips ($n$ = 77) in paper III with the different directions, and combinations, as the most limited with the PROM in the uninvolved hip as PROM norm.

*Capsular patterns.* When testing different proposed capsular patterns, only directions with less PROM, in absolute degrees, than the three norms used, one at a time, were considered. The hips with Cyriax's proposed capsular pattern for early OA, i.e. limitations in internal rotation or in internal rotation as well as flexion, were counted. The hips with limitations in flexion, abduction and internal rotation, one at a time, in combinations irrespective of ordering, and when extension or extension - external rotation followed these three directions were also counted. This was intended to correspond to Cyriax's 'Gross limitation of flexion, abduction, and medial (present authors' comment: *internal*) rotation. Slight limitation of extension. Little or no limitation of lateral (present authors' comment: *external*) rotation' (Cyriax 1982)[(p56)] (Figure 8). The hips with limitations in internal rotation - extension - abduction and external rotation, one at a time and in combinations, were also counted according to Kaltenborn (Kaltenborn 1999)[(p261)] (Figure 8).

## ACR clinical classification criteria – paper IV

In paper IV a working version of the ACR clinical criteria for classifying patients with osteoarthritic hip pain, covering flexion ROM, but not pain on internal rotation, or duration of morning stiffness, was used (Figure 6). In this version, hips were classified as ACR OA if there was self-reported hip pain, internal rotation $<15^{o}$ *and* flexion $\leq 115^{o}$, or internal rotation $\geq 15^{o}$ *and* age >50 years.

*PROM norms.* For defining decreased passive flexion and internal rotation of the hip joints in paper IV, the AAOS's estimates for normal PROM were used: flexion $120^{o}$, and internal rotation in hip extension $45^{o}$.

## Item selection and test of the new instrument HOOS LK 1.1 - paper V

*Item selection process.* All WOMAC items were included. The KOOS items and additional items were selected if they met all the criteria or only failed one, but all criteria were also tested separately for those younger than 64 years ($n$ = 24). In this younger group, six items

were included because they met all the criteria or failed only one. This was because the new instrument was intended to be patient-relevant, valid, reliable, and able to detect changes in self-rated hip problems in early treatment strategies for patients with hip disability with or without radiological hip OA.

*Test of the new instrument, HOOS LK 1.1, sub-scale construction*. The sub-scales in HOOS were selected to correspond as much as possible with the sub-scales in KOOS, so as to permit comparisons between patients with hip disability and those with knee disability. One difference has not been overcome. In the HOOS the actual sub-scores are transferred into a 0 – 100 best-to-worst score while in the KOOS a 100 – 0 transformation is used.

### *Statistics*

For an overview of the statistical methods used, see Table 7. All statistical analyses were done with the SPSS for Windows. For all tests in which p-values have been calculated, the significance level was $p \leq 0.05$.

**Table 7.** Statistical methods used in papers I to V.

| Statistical method | Paper | | | | |
|---|---|---|---|---|---|
| | I | II | III | IV | V |
| Between-group comparison | | | | | |
| - chi-square test | | • | • | • | |
| - Mann-Whitney U test | • | • | | | |
| - Student *t* test | | • | | • | |
| Correlation | | | | | |
| - Spearman | • | | | | |
| Diagnostic tests | | | | | |
| - sensitivity | | | | • | |
| - specificity | | | | • | |
| Logistic regression | | | | • | |
| Principal component analysis | | | | | • |
| Reliability | | | | | |
| - internal consistency | | | | | |
| Cronbach's alpha | • | • | | | • |
| - intraclass correlation coefficient | • | | • | • | • |
| - percent agreement | | | | • | • |
| - standard error of measurement | | | • | • | |
| Responsiveness | | | | | |
| - effect size | • | | | | |
| - standardised response mean | • | | | | |
| Shapiro-Wilks W normality test | | | | | • |
| Within-group comparison | | | | | |
| - Wilcoxon matched pairs | | | | | |
| signed rank test | • | • | | | • |

**Table 8.** Comparison between radiographic hip OA and working version of American College of Rheumatology (ACR) clinical classification criteria for symptomatic hip OA used for hips with self-reported hip pain (n = 212). Also sensitivity and specificity of ACR hip OA criteria with radiographic hip OA as gold standard.

| | Radiographic hip OA | | | | |
|---|---|---|---|---|---|
| **ACR OA** | **Yes** | **No** | **Total** | **Sensitivity** | **Specificity** |
| Yes | 115 | 58 | 173 | 115/135 = 0.85 | |
| Non | 20 | 19 | 39 | | 19/77 = 0.25 |
| Total | 135 | 77 | 212 | | |

For group comparisons of the categorical background variables, chi-square tests was used. The Mann-Whitney U-test was used in paper I to test the hypothesis that more symptoms and activity limitations would be present in those patients who had signs of radiographic knee OA, than in those without these signs. This test was also used in paper II for comparing the WOMAC and NHP sub-scale scores at test 1 and 2, respectively, between the treatment group and the control group and for change over time. For this, difference variables were constructed by subtracting the scores from test 2 from those from test 1. Student's *t* tests were used for group comparisons of age, body mass index (BMI) and PROM.

Spearman's correlation coefficient were used to compare the pre-operative administration of the WOMAC sub-scales Pain, Stiffness and Activity limitations (Function) to the sub-scales Bodily Pain and Physical Function of the Short Form 36-items of the SF-36 (Medical Outcome Study). A moderate correlation was expected. To determine divergent construct validity, the three sub-scales of WOMAC were compared with question 11a of the SF-36 ("I seem to get sick a little easier than other people": definitely true – definitely false). Correlation close to 0 was expected.

The sensitivity and specificity for ACR hip OA were calculated together with positive and negative predictive values and percentage agreement with or without correction for chance, according to standard procedures (Altman 1991). Radiographic hip OA was used as gold standard (Table 8).

To explore the influence of confounders, logistic regression analyses were performed using over/under the cut-off point values in the ACR clinical criteria for flexion and internal rotation, respectively, as dependent variables. Age, sex and OA/non-OA, were entered simultaneously as independent variables. Sex and OA/non-OA were entered as category variables.

In paper V principal component analyses, with and without varimax rotation, were performed to assess dimensionality, first for all items and secondly for each sub-scale. An eigenvalue criterion of 1.0 was used for these component analyses. The results are given in terms of percentage of variance in the scale score explained by the principal component.

Internal consistency of the three sub-scales of WOMAC was calculated on the second pre-operative administration with Cronbach's alpha (Cronbach 1951) in paper I, for the total scores of WOMAC and NHP at both test 1 and 2, respectively, in paper II, and for all HOOS sub-scales on the first test occasion in paper V.

Intraclass correlation coefficients (ICC) (Shrout and Fleiss 1979) of the two pre-operative administrations of the three sub-scales of WOMAC were calculated in paper I. In the papers III and IV ICC 3,1 and in paper V ICC 2,1 between test 1 and test 2 for each sub-scale were calculated. Standard error of measurement (SEM) was used in paper III and paper IV (Elfving et al. 1999).

Post-operative change was assessed with the Wilcoxon matched pairs, signed rank sum test. Effect size defined as mean score change divided by the standard deviation of the pre-operative score (Kazis et al. 1989), and standardised response mean defined as mean score change divided by the standard deviation of that score change (Liang et al. 1990), were used. Effect sizes over 0.8 are considered large (Cohen 1988).

The Shapiro-Wilks W test for normality was used for the HOOS sub-scales in paper V.

It was hypothesised that subjects with radiographic OA would not benefit as much from the arthroscopic procedures as would the other patients. This was tested in paper I with the Wilcoxon matched pairs-signed rank sum test.

In paper II a second post hoc analysis of the change over time was performed, in the treatment group and control group separately, with the Wilcoxon matched-pairs signed-ranks test. Comparable differences between the sub-scale scores in HOOS and WOMAC were compared with Wilcoxon in paper V.

## Results

The main results are summarised in Table 9.

**Table 9.** Main results in papers I to V.

| Paper | Main results |
|---|---|
| **I** | Validated Swedish WOMAC in both knee and hip format |
| **II** | Hip School reduces self-rated hip problems and increases health-related quality-of-life |
| **III** | No evidence found for existence of capsular pattern |
| **IV** | Clinical criteria for classifying hip disability need further development |
| **V** | HOOS, extension of WOMAC, with better prerequisite to show change over time |

WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, HOOS: Hip disability and osteoarthritis outcome score

### *The Swedish WOMAC – paper I*

Few differences were noted in the two translated versions, and the authors agreed upon a common Swedish WOMAC available in both knee and hip formats. The hip format LK 3.0 is found in Appendix D.

Thirty-five subjects completed the WOMAC twice within a mean of 5.1 ± 2.2 (2-10) days. The ICC of the three sub-scales Pain, Stiffness and Activity limitations were 0.74, 0.58 and 0.92, respectively. Cronbach's alpha was 0.83, 0.87 and 0.96, respectively.

As expected, moderate correlation was found between corresponding sub-scales of WOMAC and SF-36. Correlation close to zero was found between the three WOMAC sub-scales and the SF-36 item "I seem to get sick a little easier than other people", a construct the WOMAC is not intended to measure.

All three WOMAC sub-scales showed significant improvement for the 40 patients where post-operative data were available, with effect sizes of 0.51 to 0.71 and standardised response means of 0.63 to 0.70 (Table 10). Here scores from paper I is transformed to 0-100, best-to-worst.

### *Outcome of the Hip School - paper II*

At test 1 the scores for stiffness and activity limitations differed between the treatment group and the control group, with the treatment group experiencing more problems (Table 10). The same difference was seen for total WOMAC and NHP-pain (Figure 9).

**Table 10.** Results for WOMAC sub-scales, papers I, II and V here transformed to 0-100 best-to-worst.

| Results WOMAC | Paper | | | | | | |
|---|---|---|---|---|---|---|---|
| | I | | II | | | | V |
| | T-gr | | T-gr | | C-gr | | |
| | Pre[a] | Post | Pre[b] | Post | Pre | Post | |
| ***n*** | 40 | | 77 | | 68 | | 52 |
| **Pain** | | | | | | | |
| - Mean | 51 | 35 | 31 | 28 | 29 | 30 | 26 |
| - SD | 23 | 28 | 14 | 16 | 16 | 18 | 17 |
| - Median | - | - | 30 | 30 | 30 | 35 | 25 |
| - Interquartile range | - | - | 20 | 25 | 25 | 30 | 24 |
| - P-value | 0.0002 | | 0.083 | | - | | - |
| - Effect size | 0.71 | | 0.22 | | - | | - |
| - SRM | 0.70 | | 0.22 | | - | | - |
| **Stiffness** | | | | | | | |
| - Mean | 44 | 29 | 45 | 40 | 36 | 37 | 39 |
| - SD | 24 | 25 | 20 | 18 | 23 | 24 | 21 |
| - Median | - | - | 50 | 50 | 38 | 38 | 38 |
| - Interquartile range | - | - | 38 | 25 | 34 | 38 | 25 |
| - P-value | 0.0004 | | 0.062 | | - | | - |
| - Effect size | 0.65 | | 0.24 | | - | | - |
| - SRM | 0.70 | | 0.22 | | - | | - |
| **Activity limitations** | | | | | | | |
| - Mean | 37 | 27 | 33 | 29 | 24 | 27 | 30 |
| - SD | 21 | 22 | 17 | 17 | 18 | 19 | 20 |
| - Median | - | - | 32 | 25 | 20 | 25 | 28 |
| - Interquartile range | - | - | 27 | 24 | 29 | 35 | 35 |
| - P-value | 0.0001 | | 0.040 | | - | | - |
| - Effect size | 0.51 | | 0.25 | | - | | - |
| - SRM | 0.63 | | 0.29 | | - | | - |

[a] Tested before arthroscopy, [b] Tested before Hip School, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, SD: standard deviation, Effect size: mean score change/SD of pre-treatment score SRM: mean score change/SD of that score

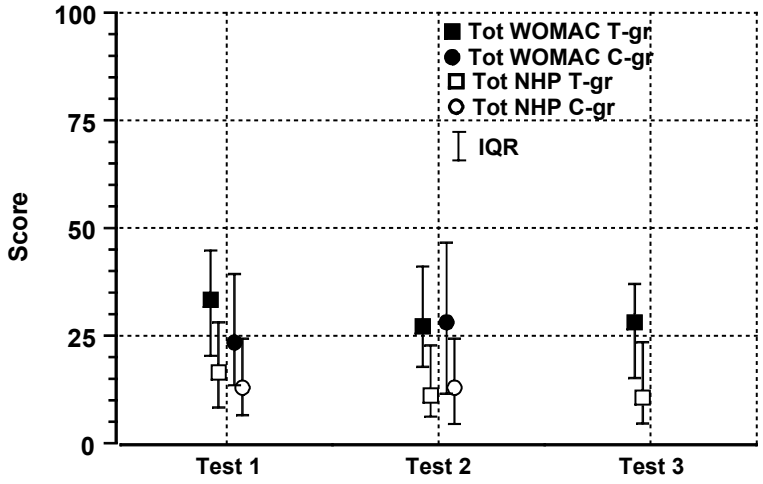


**Figure 9.** Median score together with interquartile range (IQR) for total Western and Ontario McMaster Universities Osteoarthritis Index (WOMAC) and total Nottingham Health Profile (NHP) for the treatment group (T-gr) and the control group (C-gr) at test 1 and test 2. For the T-gr also scores from test 3, one year after the first test.

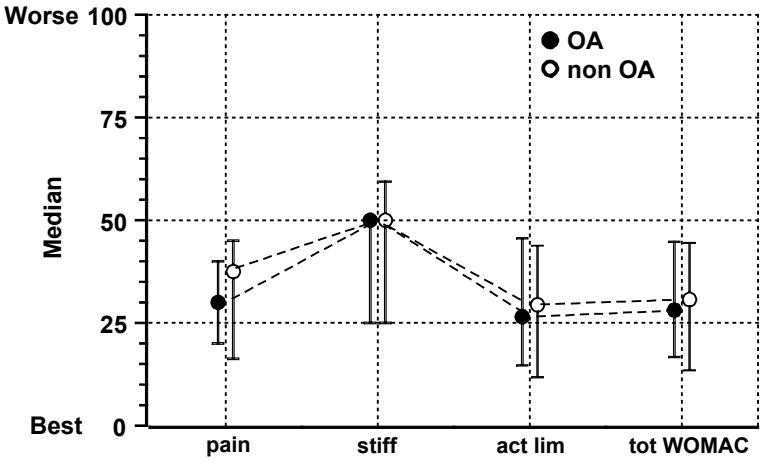


**Figure 10.** Median scores for the three Western and Ontario McMaster Universities Osteoarthritis Index (WOMAC) sub-scales pain, stiffness (stiff) and activity limitations (act lim), together with interquartile range (IQR) for hip osteoarthritis (OA) and non-hip OA.

Between persons with hip OA ($n$ = 99) and those with non-OA ($n$ = 46) there were no differences at test 1 in pain, stiffness, activity limitations (Figure 10) or in the sub-scales of NHP, except in sleep disturbances where the non-OA group had more problems.

There were no differences between persons with unilateral hip pain and bilateral hip pain in self-rated hip pain, stiffness or activity limitations.

Comparison of change-over-time scores between the treatment group and control group using the computed difference variable for WOMAC showed differences in favour of the treatment group for pain, activity limitations, total WOMAC and NHP (lack of) energy sub-scale.

Post-hoc analysis revealed no differences between the groups on any of the sub-scales or total scores of WOMAC or NHP at test 2 (Figure 9).

In the second post-hoc analysis, when the change-over-time scores were analysed with within-group comparisons, there were no significant changes for the control group while the treatment group showed reductions in activity limitations and total WOMAC scores ($p < 0.05$, respectively). There was also reduction for the treatment group in NHP sleeping disturbances ($p < 0.05$), in NHP pain ($p < 0.001$), in NHP physical mobility ($p < 0.01$) and in total NHP scores ($p < 0.001$).

At test 3, one year after the first test, the patients in the treatment group had not worsened their scores, compared to test 2, either in the WOMAC sub-scales or in the NHP sub-scales (Figure 9).

## Who benefits most?

Assuming that the total WOMAC scoring reflects the seriousness of the hip problems and that score change between test 2 and test 1 are a measure of how much one benefits, some preliminary results can be brought out from this study.

In Figure 11 the seriousness of the hip problems is plotted on the x axis and the reduction of total WOMAC scoring on the y axis for treatment group and control group, respectively. Minus scores correspond to alleviation of hip problems. There were group differences in this change score.

Dividing the treatment group ($n = 77$) into two by the median of the total WOMAC change score showed no differences in age, sex, OA or not, or pain score (WOMAC) between these groups. However, persons with higher BMI, higher stiffness and activity limitation scoring in WOMAC reduced their total WOMAC scorings the most.

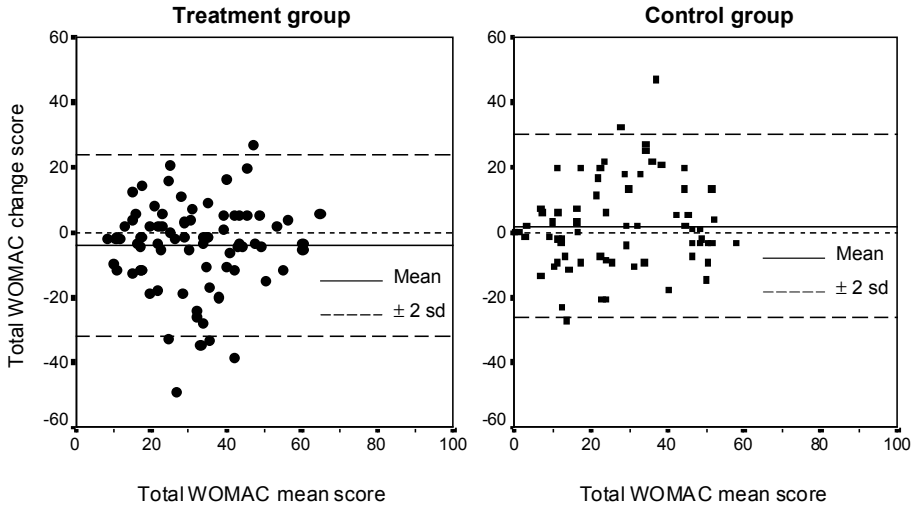


**Figure 11.** The individuals in the treatment group ($n = 77$) and the control group ($n = 68$) are plotted on the x-axis as mean score between test 1 and test 2 and on the y-axis as change score (test 2 score subtracted from test 1 score). Minus scores, alleviation of hip problems. Continuous horizontal line for group means, dotted lines for 0 (no change) and also for ± 2 standard deviations (sd).

One person in the treatment group, to the left in Figure 11, shows a reduction of total WOMAC score by over 50. This was a 57-year-old woman with no hip OA but bilateral hip pain < 6 months but more than 3 months. She was married, lived in a small village and worked at the old people's home. Reporting on what the Hip School had meant to her, she wrote, "I have learnt how important it is to walk, stand, sit, correctly; move your legs while sitting. How important it is to stand up after sitting for a time. To consider your problems in a more positive way, to learn how to handle the disease".

### *Passive hip range of motion*

Of the 168 patients in papers III and IV, 50 had no hip OA, 77 had unilateral hip OA and 41 had bilateral hip OA according to the radiological reports (Table 1). As there were age and gender differences between OA patients and non-OA patients (Table 2), logistic regression analyses were made. Table 11 demonstrates the relationships between radiological signs of hip OA, internal rotation < $15^{o}$ and flexion ≤ $115^{o}$ for the whole group ($n$ = 336) as dependent variables, and the independent variables of age, sex and OA or non-OA. Being male contributed almost as much as having OA to the risk of having internal rotation < $15^{o}$.

Mean PROM differed in all directions between hips with OA and those without (Figure 12), and also between the sexes. For hips in patients 65 years or older, there were significant differences in all directions, except adduction and external rotation, compared to younger patients. Differences in male and female proportions and age between patients with and without OA (Table 2) prompted analyses for OA and non-OA hips for males and females, and older and younger, separately. These showed the same differences between OA and non-OA.

**Table 11.** Logistic regression analyses for flexion ≥ $116^{o}$ or ≤ $115^{o}$ and internal rotation ≥ $15^{o}$ or < $15^{o}$ for the whole group ($n$ = 336) as dependent variables, and age, sex, osteoarthritis (OA) or non-OA as independent variables. Sex and OA or non-OA was entered into the model as category variables.

| | **Flexion ≥ $116^{o}$ or ≤ $115^{o}$** | | | **Internal rotation ≥ $15^{o}$ or < $15^{o}$** | | |
|---|---|---|---|---|---|---|
| **Independent variables** | **Wald** | **Sig of Wald** | **R** | **Wald** | **Sig of Wald** | **R** |
| Age | 4.61 | 0.03 | -0.08 | 0.65 | 0.42 | 0.00 |
| Sex | 13.66 | 0.00 | -0.16 | 16.12 | 0.00 | -0.22 |
| OA/non-OA | 37.40 | 0.00 | 0.28 | 26.98 | 0.00 | 0.29 |

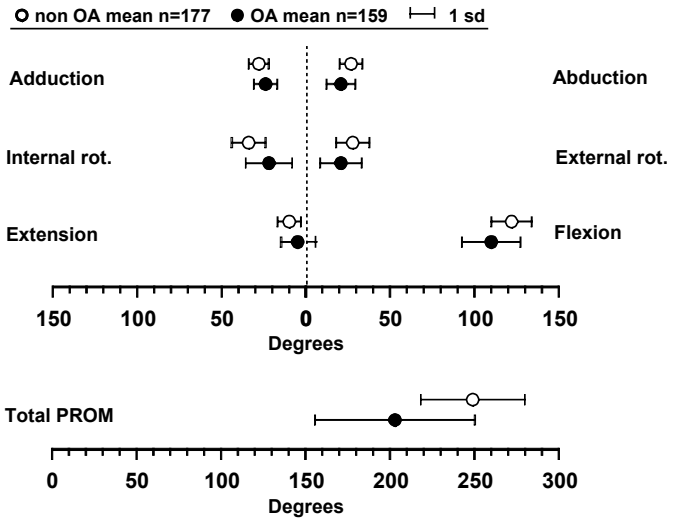


**Figure 12.** Means for passive range of motion (PROM) and standard deviations (sd), for osteoarthritic (OA) hips ($n$ = 159) and non-OA hips ($n$ = 177), for the six different directions tested and for total PROM.

Among patients with unilateral hip OA ($n$ = 77), 14 (18%) had decreased PROM in all directions in the OA hip compared to the non-OA hip. *The other 63 (82%) patients had equal or more PROM in the OA hip than in the non-OA hip in between 1 to 5 directions (mean 2).* Equal or more PROM in the OA hip was most common in extension (31 cases), followed by external rotation and abduction; and less common in internal rotation (13 cases).

### *PROM and capsular patterns – paper III*

For OA hips ($n$ = 159) there were 68, 70 and 129 different PROM patterns, depending on PROM norm used, and for non-OA 68 and 138 ($n$ = 177). The proportion of hips with limitations in all six directions varied between 0 and 21%, depending on the PROM norm used.

#### Tests of Cyriax's capsular pattern

Five OA hips (3%) and 1 non-OA hip (<1%) had internal rotation followed by flexion as the two most limited directions when the PROM from the symptom-free hips was used as norm and five OA hips (3%) when Kaltenborn's PROM norms were used.

For unilateral hip OA with PROM in the uninvolved hip as norm, nine hips (12%) had most limitations in internal rotation followed by flexion and 1 hip (1%) had most limitations in flexion, abduction or internal rotation followed by extension (Figure 8).

Limitations in abduction followed by flexion and internal rotation, irrespective of the ordering between them, occurred in 11 OA hips (7%) and 1 non-OA hip (<1%) when using the PROM norms from the symptom-free hips. When using Kaltenborn's PROM norms, 33 OA hips (21%) and 18 non-OA (10%) were found, and seven hips (9%) when using the uninvolved side as PROM norm.

### Test of Kaltenborn's capsular pattern

One non-OA hip (<1%) had limited internal rotation and extension, with the PROM in the symptom-free hips as norms and one OA hip (1%) with the uninvolved side as norm (Figure 8).

## *Diagnostic tests of the ACR clinical criteria – paper IV*

Among the 212 hips with self-reported hip pain in paper IV, the prevalence of radiological signs of hip OA was 0.64 ($n$ = 135). When comparing the working version of the ACR clinical criteria and the radiological reports, 115 hips had OA with both classification systems, giving a sensitivity of 0.85 and a specificity of 0.25. Twenty hips with self-reported hip pain had radiological signs of hip OA but had non-ACR OA (Table 8). The positive predictive value was 0.66 and the negative predictive value 0.53. Percentage agreement was 0.63 and, when corrected for chance, 0.11, which is to be considered poor.

Totally 78 hips (37%) were classified with disagreement: twenty-three of the male hips (29 %) and 55 of the female (42%). The combination of passive internal rotation ≥ $15^{o}$ and age > 50 years gave most of the disagreements for both male and female hips ($n$ = 56).

## *HOOS – the extension of the WOMAC – paper V*

### Four criteria for the item selection process

*Criterion A* was test-retest agreement of the scorings of each item of 60% or more. All items were examined with regard to percentage of patients reporting best possible scores (no pain, no stiffness, no activity limitations, never or not at all), making it impossible to show improvement over time when using e.g. a responder criterion to categorize an individual's response to treatment (Dougados et al. 2000). Thus *criterion B* was whether an item scored minimum (0) in fewer than 30% of the cases. The mean score of the WOMAC items was 1.2. Items with higher mean scores (more symptoms) would increase sub-scale scores in the new instrument and further permit ability to detect change in patients, on a group basis, over time. *Criterion C* was selected as a mean score higher than 1.2 for each item. Finally the importance of each item was rated with three alternatives: unimportant, somewhat important or very important (scored 1, 2 or 3); not, however, intended to be a part of the HOOS LK 1.1 instrument. *Criterion D* was met if fewer than 20% of the subjects scored the item as 'unimportant'. Based on the results, ten of the 18 KOOS and all five additional items were included in the HOOS LK 1.1 (reported in appendices B and C).

### Test of the new questionnaire

HOOS LK 1.1 was established with 39 items, in five sub-scales, Pain (P), Symptoms (other, including stiffness) (S), Activity limitations – daily living (A), Activity limitations – sport and recreation (SP) and Hip-related Quality of life (Q). To enhance the interpretation, all sub-scale scores were transformed in the data analysis to 0-100, best-to-worst. For user's guide see appendix A.

The intra-class correlation coefficients (ICC 2,1) for the HOOS sub-scales were for Pain 0.89, Symptoms (other) 0.86, Activity limitations – daily living 0.89, Activity limitations – sport and recreation 0.91 and Hip-related Quality of life 0.78, which must be considered high. On the first test occasion the Cronbach's alphas were as follows: Pain 0.93, Symptoms 0.82, Activity limitations – daily living 0.96, Activity limitations – sport and recreation 0.88 and Hip-related Quality of life 0.77, which must be considered acceptable.

In HOOS, 38% of the items had a floor effect (Criterion B) compared to 58% in the WOMAC. Three of the HOOS sub-scales showed higher medians (more symptoms) than the WOMAC did, with the highest median in the newly-added Hip-related Quality of life and Activity limitations – sport and recreation, where median scores were 44 and 41, respectively (Table 12). The items in the Symptoms sub-scale are very disparate. Half our patients assessed zero in one or more of the new items. Due to the mathematical procedure when transforming the sub-scale scores to 0-100, many zero assessments resulted in lowered sub-scale scores (less symptoms).

One single component was found when the items in the five sub-scales, one at a time, were entered in within-scale principal component analysis with varimax rotation, explaining between 59 and 73% of the scale score variance. There was one exception: the sub-scale Activity limitations – daily living loaded on two components, with the first explaining 59% of the variance and the other 8%. Varimax rotation revealed that the first comprised activities with heavy loading and maintenance of postures while the second comprised mostly activities that required a good ROM.

### *Comparison of WOMAC scores*

In table 10 the sub-scale scores of WOMAC from papers I, II and V are presented together with p-values (Wilcoxon matched-pairs signed-rank test), effect sizes and standardised response means. The mean scores in the treatment group before Hip School were not high, which gave low effect sizes and SRM. As seen in Table 12 three of the HOOS sub-scales showed higher means than the WOMAC did. For mathematical reasons, this improves the HOOS's ability to detect clinically important change over time.

**Table 12.** Comparison of sub-scale scores of Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and Hip disability and osteoarthritis outcome score (HOOS), paper V.

| **Comparison WOMAC and HOOS sub-scale scores** | **Paper V** | |
|---|---|---|
| | **WOMAC** | **HOOS** |
| ***n*** | 52 | |
| **Pain** | | |
| - Mean | 26 | 33 |
| - SD | 17 | 20 |
| - Median | 25 | 31 |
| - Interquartile range | 24 | 33 |
| - P-value | 0.000 | |
| **Symptoms (other including stiffness)** | | |
| - Mean | 39 | 37 |
| - SD | 21 | 21 |
| - Median | 38 | 35 |
| - Interquartile range | 25 | 30 |
| - P-value | 0.404 | |
| **Activity limitations – daily living** | | |
| - Mean | 30 | |
| - SD | 20 | |
| - Median | 28 | |
| - Interquartile range | 35 | |
| - P-value | - | |
| **Activity limitations – sport and recreation** | | |
| - Mean | - | 43 |
| - SD | - | 27 |
| - Median | - | 41 |
| - Interquartile range | - | 47 |
| - P-value | - | |
| **Quality of life – hip related** | | |
| - Mean | - | 45 |
| - SD | - | 20 |
| - Median | - | 44 |
| - Interquartile range | - | 31 |
| - P-value | - | |

SD: standard deviation

# Discussion

The overall objective of the work presented in this thesis was to develop an early educational treatment in primary care for people with hip disability – a Hip School – and to assess its effects on self-rated hip problems and health-related quality of life. The objectives were further to analyse common diagnostic and classification criteria and improve instruments for assessing self-rated hip problems. The results show that the Swedish version of WOMAC is a reliable, valid, and responsive instrument with measurement qualities in line with the original version. Assessment of the Hip School showed that the patients' reduced their pain and activity limitations and improved their health-related quality of life. No evidence was found for the existence of a capsular pattern of the hip as defined by either Cyriax or by Kaltenborn, while from 68 to 138 different PROM patterns were found, depending on what PROM norms were used for defining limitations. In this population, with the methods used, the ACR clinical classification criteria did not agree well enough to replace radiological examination. The ability to detect clinically meaningful changes was better when WOMAC was extended with items and sub-scales in HOOS.

## *Methodological considerations*

### Definitions and naming of hip problems

Great problems of defining and naming hip problems were encountered throughout the work reported in this thesis. This perhaps explains why three of the five papers address these problems: not to offer any answers, but rather to disconfirm some common conceptions. OA is still an enigma difficult to define; it represents a continuum where tissue alterations may occur long before we know of them, maybe in that stage always asymptomatic. The present patients had hip disability with pain, all other possible diagnoses excluded. Those whose hips showed no radiographic changes with the techniques and evaluation methods used maybe had "pre-radiographic hip OA". Given the slowly changeable nature of the condition, it takes long to see what is happening. Maybe, as Petersson (1999) suggests, macromolecular fragment quantification will make it possible in the future to better monitor the early stages of the OA process.

### Patient education

Education should form an integral part of the management of chronic diseases. In addition to the professional responsibility, the education itself may have an impact on the outcome of disease (Pendelton et al. 2000).

In an editorial, Harms-Ringdahl (1998) has discussed the use of the word 'physiotherapy' as if this were *one* treatment modality. The some problem goes for patient education. Many aspects of patient education must be considered and discussed. Who should be educated? key messages? what outcomes are aimed at? who should deliver the education and in what form? The present ambition has been to describe the Hip School in as much detail as possible without writing a whole book.

One of the key concepts in the Hip School that needs to be further addressed, however, is "lagom" - how to balance activity and acceptable pain during the activity, immediately after and the day after. Thomeé (1997) used a Pain Monitoring System with a VAS 0-10 scale with the wordings 'safe' between 0 – 2, 'acceptable' between 2 – 5, and above 5 'at risk', not recommended.

The ”Hip School” seeks to affect thoughts, feelings, and behaviour. The degree of adherence is not known. Hip problems pose no immediate risks or threats, but require life-style changes. This might give high levels of non-adherence (Meichenbaum and Turk 1987). On the other hand, if the negative emotions that can be associated with hip problems (sadness and fear) and the specific behavioural tendencies this emotions can give rise to (inactivity and avoidance) are dealt with (Lazarus 1991) and the proposed behaviour changes make sense and require little time or effort, this might facilitate adherence. Reduction of fear so as to change “illness behaviour to wellness behaviour” has been discussed earlier in a physiotherapy perspective (Williams 1989). The simple mechanical wear-and-tear model can reinforce inactivity and avoidance (Donovan and Blake 1989), further contributing to progression of disability. In educational interventions it is difficult to distinguish between “true effects” and placebo effects (Wall 1994, Kaptchuk 1998). Some of the effects of the “Hip School” might be due to a change from one thought pattern with nocebo effects to another with powerful placebo effects.

## Questionnaires

Both generic health-related quality-of-life instruments, the SF-36 and the NHP, and more specific OA instruments, were used. Our study groups had their main problems in pain and more physical aspects, enabling only parts of these instruments to show change over time.

The underlying data for the WOMAC and the HOOS are ordinal and for this reason non-parametric statistics have been used in throughout all papers. In “The WOMAC Osteoarthritis Index. A User’s Guide”, Bellamy (1995) discusses the pros and cons of using parametric and non-parametric analysis when dealing with WOMAC data. In the present thesis median and interquartile range are reported. Since the reporting of mean and SD is so common for WOMAC, they have also been presented in some cases.

The method for transforming the sub-scales in both WOMAC and in HOOS to a 0 – 100, best – to worst scale does not change the mathematical properties of the scoring: it only stretches out the scorings in the sub-scales to the same length (Figure 13). On the other hand this can give a false precision (Svensson 2001).

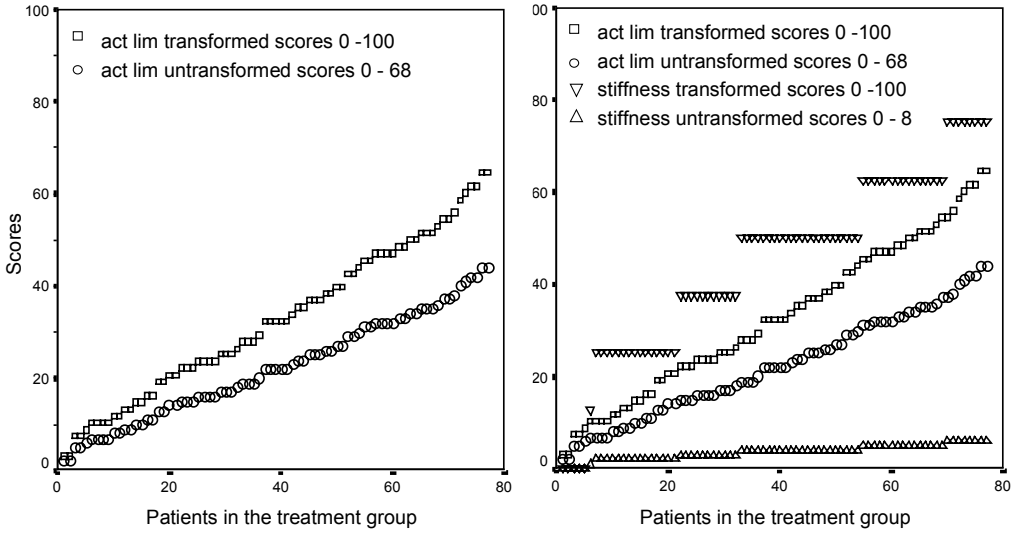


**Figure 13.** Comparison between the plotted individual scoring ($n$ = 77) for the summed (0 – 68) and the transformed scores (0 – 100) in the activity limitation (act lim) sub-scale with 17 items to left. To the right also the summed score for the stiffness sub-scale with 2 items (0 – 8) and the transformed score (0 – 100) in the WOMAC.

### PROM testing

The reliability of the PROM testing was tested in a separate study with the same examiner, using the same test protocol. Test-retest intra-rater reliability was moderate-to-high. Due to less reliable testing of passive extension, external rotation and adduction, the ordering of the directions may err in some cases. The reliability would certainly have been better if the examiner had had an assistant for the measurements (Holm et al. 2000), but this was not possible. The validity of the methods used must also be discussed. The PROM values are based on just one test occasion and both the within-patient variability and the course of development of limitation are unknown. Further, the validity of the method used for measuring extension can be questioned. It was decided that all motion should, if possible, be derived from a neutral zero starting position. If the pelvis is properly stabilised, measurement of hip extension in prone position requires at least $0^{o}$ of extension ability. We expected to find a large proportion of subjects with extension deficits. The need for uniformity, including positioning, was the main reason for choosing the measurement method described by AAOS (Greene et al. 1994) as a measure of flexion deformity for measuring extension in supine subjects. Internal and external rotation were measured in prone position. Only one patient could not be measured in this position due to his extension deficits ($-28^{o}$). All these factors might affect the PROM values obtained and the ordering of the directions in PROM patterns; but scarcely the great variability and the infrequency of capsular patterns.

"Normal" PROM does not seem to exist. But to define limitations, some kind of estimate must be used. Two of three PROM norms used, from the symptom-free hips and in the patients with unilateral hip OA, the PROM in the uninvolved hip were derived from our own data. In these cases, threats to the validity of the measurement methods are of smaller interest. We also used Kaltenborn's published norms for defining limitations. Another manner of defining PROM norms could change the ordering between directions, the number of hips with the same pattern and the frequencies of most limited direction for many of the hips in our study. It should not, however, alter the fact that we did not find one or a few PROM patterns but a multitude. When we tested Kaltenborn's proposed capsular patterns his stated PROM norms were used. This changed the number of PROM patterns found somewhat, but not the fact that we did not find one dominant pattern. In fact none of the OA hips had Kaltenborn's proposed ordering of limitations.

PROM can still constitute an important assessment tool. Given the great individual variations i.e. due to age and sex, findings can be interpreted in new ways and used not to diagnose but to decide about referring the patient to radiography (Birrel et al. 2001).

## *Findings and clinical implications*

Assessment of the Hip School showed that the participants reduced their pain and activity limitations and improved their health-related quality of life after six months, with effects maintained after one year. The Hip School is proposed for wider use as an early treatment strategy for persons with hip disability. If Hip School, together with other non-surgical treatments, can be used more systematically the need for THR will for some persons be postponed. This especially important for the risk groups for revision of THR, namely younger persons and mostly younger men.

No support was found for the existence of a capsular pattern in the hip. The concept needs to be re-examined. It was impossible to anticipate radiological evidence of hip OA from the multitude of PROM patterns. OA is clinically more heterogeneous than this. In clinical

practice we need to consider all clues we can get about the unique patient with whom we are dealing in order to help the best we can.

Conceptually, classification criteria could be the same as diagnostic criteria, if sensitivity and specificity are either 100% or nearly so (Altman 1991). Here the sensitivity of the ACR clinical classification criteria was 0.85 and the specificity 0.25. They thus did not agree well enough to replace radiological examination.

In addition to the attempts to try to medically diagnose clinical hip OA, teaching us to seek changes in body structures / functions, and limitations in activity / participation separately, we could classify clinical hip disability with the ICF (WHO 2001). In this perspective, radiological signs of hip OA can be considered as significant deviations of body structures, related to movement of the lower extremity and the hip joint, with five qualifiers (from no problems to mild, moderate, severe or complete problems). Decreased PROM can be considered as deviations of body functions, mobility of a single joint and so on. More research is needed to further develop the classification and clinical diagnostic procedures of hip pain.

The Swedish WOMAC had measurement qualities that agree well with the original version. The items in the extended version, HOOS, met a set of criteria for validity, reliability and prerequisites for the ability to detect clinically important change in patients over time. The HOOS thus appears to be useful for assessing important self-rated hip problems for people with hip disability in early stages and in hip disability without hip OA.

### *Future research*

Hip disability imposes both important community health care burdens and challenges (Pendleton et la. 2000). For the individual, hip disability can be a threat not only to present health but also in the future. The body is always at the centre of one's experience, normally without being in focus. With hip disability, something abnormal is experienced. The functioning of the hip is important for walking (independence), dancing (fun) and sexual drive and function (Allen et al. 1998). In many cases, a person with hip problems is in reality a family with hip problems.

Independently of the Hip School development and the concept of "low-use behaviour", other authors have been working with similar concepts: "the disuse syndrome" (Bortz 1984), fear-avoidance beliefs and fear of movement (Linton and Buer 1995, Linton et al. 2000) and the avoidance model (Steultjens et al. 2002). Cross-fertilisation between these concepts and models would certainly lead to better understanding of the disablement process in OA, including ageing and preventive strategies. Also the salutogenic perspective and Antonovsky's concept SOC would be ways to further develop the Hip School.

As far as is known, the present assessment of the Hip School is the first study in early contact and health education solely for persons with hip disability, hip OA included or not, seeking to enable them to cope and to improve or maintain physical ability. The results must be regarded as preliminary, since quantitative, randomised and qualitative studies are needed to develop and evaluate the Hip School. Further 'micro-perspective' studies are needed to address questions such as; Who needs a booster dose of the Hip School message? Who needs other additional interventions? In the "macro" perspective questions concerning cost-effectiveness are seeking answers.

There are very few studies concerning the prognosis of hip OA and none concerning the prognosis for hip disability without hip OA.

According to Kirshner and Guyatt (1985) the potential applications of health status measures can be divided into three broad categories; discrimination, prediction and evaluation. Much work in all these three categories has to been done on health status instruments for persons with hip problems. Validation of assessments is an ongoing process. Further studies are needed to validate the HOOS for different populations. Normative HOOS data for the general population is also needed as are tests of HOOS's ability to diagnose hip disability.

In both WOMAC and HOOS the scores on each sub-scale item are summed to a sub-scale score. These summed sub-scale scores do not reveal the problems in individual items. Analysis of individual items (Eriksson 2002), use of profiles (ter Steeg and Lankhorst 1994) or single global scales (Svensson 2001) may develop the use of the instruments. Research is needed on how to analyse and present WOMAC and HOOS data.

Linking both WOMAC and HOOS to the ICF by using the ten linking rules proposed by Cieza et al. (2002) may be needed. In future research, maybe the concept hip disability should be used more frequently instead of, or as a complement to, hip OA.

## Conclusions

WOMAC in its Swedish version is a questionnaire with measurement qualities well in line with the original version.

The Hip School can help persons with hip disability to reduce their self-rated hip problems and increase their health-related quality of life.

Naming by symptoms, hip problems or hip disability, can suffice as long as we do not have a clear hip OA diagnosis. When we have, words like ‘worn-out’ or ‘wear and tear’ should be changed to ‘joint failure’ or ‘joint space narrowing’, which better reflect our present understanding and promote healthier behaviour. If not using the word osteoarthritis.

There were no differences in self-rated hip problems of health-related quality of life between persons with hip OA and those without, except for sleeping disturbances, where the persons without hip OA had more problems.

On group level the persons with hip OA had less passive PROM than those without, but there were also differences due to age and gender. Being male contributed almost as much as having hip OA to the risk of having decreased hip PROM. Among patients with unilateral hip OA 72% had equal or more PROM in the OA hip than in the non-OA hip in between 1 to 5 directions (mean 2).

There was no evidence for the existence of a capsular pattern i.e. a special ordering of PROM limitations, either that proposed by Cyriax or that proposed by Kaltenborn. Instead, over 100 different PROM patterns were found.

The American College of Rheumatology classification criteria for symptomatic hip OA need further development since, in this population and with the methods used, they did not agree well enough to replace radiological examination.

HOOS appears to be an evaluative instrument useful for assessing important self-rated hip problems in persons with hip disability both with hip OA and without hip OA.

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## Appendices

A. **A user's guide to the HOOS**
B. **Swedish version of the HOOS**
C. **English version of the HOOS**
D. **Swedish version of the WOMAC**

**When copying the questionnaires**
Use a magnifying factor of 123% to receive a European size A4, suitable for patient administration. The Swedish version of the WOMAC is to be copied in landscape view on both sides of the sheet, folded to get a booklet with 4 pages.
The instruments can be downloaded from www.liv.se/kff.htm