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AN EDUCATIONAL TOOL OF EXERCISE THERAPY FOR PEOPLE WITH EARLY SYMPTOMS OF HIP OSTEOARTHRITIS

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The purpose of this thesis was to create an educational tool to increase the knowledge of hip osteoarthritis and the awareness of the benefits of exercise therapy among people with early symptoms of hip osteoarthritis. In addition, physiotherapy students may increase their knowledge about hip osteoarthritis by utilizing this tool as part of their studies.

Hip osteoarthritis is a disorder affecting many people. It is the most common reason for total hip surgery, thus, overloading the health care systems. However, often the health care only considers people with advanced hip osteoarthritis leaving the people with early symptoms of hip osteoarthritis with slight or no care. From the human reasons and economical point of view it is extremely important to direct the attention towards the patients with early symptoms of hip osteoarthritis and the prevention of the disorder.

The conservative treatment is the key aspect to be focused on in an early phase of the disorder. Thus, it is suggested that a great attention should be directed to patient guidance, risk factors and client's engagement to physical activities. It is noticed that patient education provides several benefits for people with osteoarthritis. The tool was created to respond the demands of the treatment of hip osteoarthritis.

The tool includes the evidence-based knowledge about hip osteoarthritis. It describes the anatomy of hip, osteoarthritis and its risk factors, and the suitable exercises as a video format. The tool was selected to be a computer-based CD-ROM, because it is convenient and easy to use, it enables the patient always to return to the exercises and the correct techniques of those. It also easily reaches people from all over the world and enables the usage of the tool with no restrictions of time or place.

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1 INTRODUCTION

Osteoarthritis is the most common form of arthritis (National Collaborating Centre for Chronic Conditions 2008, 3). Only in Finland 400 000 people have the symptoms of the knee or hip osteoarthritis (Hannonen & Airaksinen 2005, 217-219). These people suffer from pain, physical disability and poor health status. Also, osteoarthritis is the most common reason for total hip replacement surgery. (Fransen, McConnell, Hernandez-Molina & Reichenbach 2009, 2; National Collaborating Centre for Chronic Conditions 2008, 3). Osteoarthritis affects the quality of life and overloads the health care services. From the both humane reasons and the economical point of view it is evident that more care is required to be directed towards the patients with early symptoms of osteoarthritis and the prevention of the disorder (Hannonen & Airaksinen 2005, 217-219).

Vogels et al. (2003, 26) noticed in their study that only half of the elderly people knew that controlled moderate exercise is not harmful if having a knee or hip osteoarthritis. This shows clearly the lack of knowledge among people with osteoarthritis. According to Cibulka et al. (2009, A15) patient education provides several benefits for these people.

Because of the remarkable occurrence and the lack of awareness of the disorder, I decided to concentrate on exercise therapy for people with early symptoms of hip osteoarthritis. The result of this thesis is a CD-ROM, which consists of basic knowledge about hip, osteoarthritis, risk factors and exercise therapy. The tool is a method that enables people with hip osteoarthritis to educate themselves by learning more about the disorder, and giving them possibilities to help them. The computer-based tool was chosen because of the convenient way to show the correct exercise techniques through videos, and it also easily reaches people all over the world.

2 AIM OF THE THESIS

The aim of the thesis is to create an educational multimedia tool, which increases the knowledge of hip osteoarthritis and which suggests the exercises for people who have a risk of developing hip osteoarthritis or already have early symptoms of hip osteoarthritis. Also, physiotherapy students can utilize this tool as part of their studies to preconceive or to improve the knowledge of hip osteoarthritis.

3 HIP OSTEOARTHRITIS

3.1 Anatomy of hip

Head of femur and acetabulum of the hip bone form a ball-and-socket hip joint (Figure 1.). Ball-and-socket joint refers to a ball-shaped bone fitting into a cuplike depression of another bone. This joint is multiaxial, thus having movements to all directions (flexion, extension, abduction, adduction, circumduction and rotation). (Agur & Dalley 2005, 358-369) The muscles responsible of the main hip actions are stabilizers (m. iliopsoas, m. rectus femoris, m. gluteus maximus, m. gluteus medius, m. gluteus minimus and m. obturator externus), flexors (m. iliopsoas, m. rectus femoris and m. sartorius), extensors (m. gluteus maximus, m. biceps femoris, m. semitendinosus and m. semimembranosus), abductors (m. gluteus medius, m. gluteus minimus, m. tensor of fascia lata and m. sartorius) and adductors (m. pectineus, m. adductor longus, m. adductor brevis, m. adductor magnus and m. gracilis). (Tortora & Derrickson 2006, 270-271)

3.2 Osteoarthritis

Osteoarthritis (OA) is a complex disorder and is the most common form of arthritis (National Collaborating Centre for Chronic Conditions 2008, 3). It is related to "joint pain, physical disability and poor health status, and is the most common reason for total hip replacement surgery" (Fransen, McConnell, Hernandez-Molina & Reichenbach 2009, 2). Therefore, it also affects the quality of life (National Collaborating Centre for Chronic Conditions 2008, 3). Patients suffering from OA overload the health care services and thus special attention is directed to treating the patients with advanced OA. This leads to inadequate care of the patients with mild symptoms of OA and to inadequate prevention of the disease. It is suggested that greater results could be achieved in assessing and treating the difficulty of OA by multiprofessional teams, which consist of medical care, patient counselling, social support, physiotherapy and occupational therapy. (Hannonen & Airaksinen 2005, 217-219)

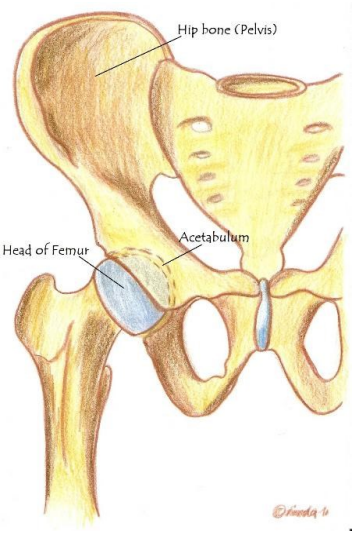

Figure 1. Healthy hip

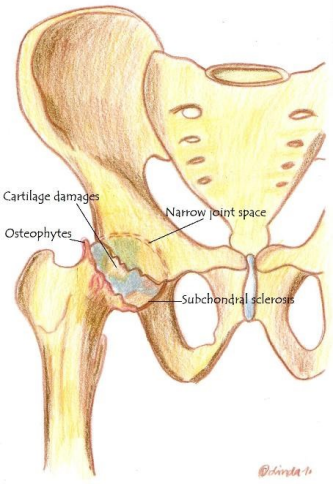

Figure 2. Osteoarthritic hip

OA occurs mainly in knees, hips, back, neck and hands (Bartels, Lund, Hagen, Dagfinrud, Christensen & Danneskiold-Samsøe 2007, 3). The most common findings in OA are pain and restricted mobility of the joint, the loss of joint cartilage and the hypertrophy of the bony parts of the joint (osteophytes) (Figure 2.), which are based on radiological findings (National Collaborating Centre for Chronic Conditions 2008, 3). Recently the health care system has woken up to the need for conservative treatment. Only in Finland 400 000 people have the symptoms of the knee or hip OA. (Hannonen & Airaksinen 2005, 217-219)

The reasons for OA are insufficiently known but suggestions are that genetic, constitutional and biomechanical factors together have an impact on OA. Hannonen & Airaksinen (2005, 217-219) claim that genetic factors are rare but National Collaborating Centre for Chronic Conditions (2008, 3) state that heritability estimates are high (40-60%) for hand, knee and hip OA. Lifestyle factors (overweight, muscle weakness), environmental factors (physically loading work or heavy physical activities) and tissue qualities (hypermobile joints) seem to expose to OA. (Hannonen & Airaksinen 2005, 217-219; National Collaborating Centre for Chronic Conditions 2008, 3) Biochemical changes of joint cartilage and synovial membrane, the damages to joint cartilage or to other joint tissues, and the stress on subchondral bone because of an accident or other diseases affect the development of OA. (Hannonen & Airaksinen 2005, 217-219) Progression of the hip OA is variable but it seems to be more rapid than in knee OA (Fransen et al. 2009, 2).

OA is often referred as a disease when in the matter of fact it is a repair process itself. Several joint traumas initiate the repair process of all the joint tissues, increasing the activity of cells and the production of new tissue. This process often repairs the original trauma, but is concurrent with the changes of the joint. However, sometimes, "the osteoarthritis process cannot compensate, resulting in continuing tissue damage and eventual presentation with symptomatic osteoarthritis or 'joint failure'. This explains the extreme variability in clinical presentation and outcome", therefore the diagnosis of OA may be difficult. (National Collaborating Centre for Chronic Conditions 2008, 3&6).

Diagnosis is based on the symptoms the patient describes, clinical and radiological findings and on the possible differential diagnosis based on the laboratory tests. (Käypä hoito –suositus 2007, 604) Diagnosis of hip OA might also be difficult due to the similar symptoms in different diseases such as bursitis or tendinitis, muscle strain, osteonecrosis or rheumatoid arthritis. However, there is strong evidence about few symptoms, which are typical in patients who have radiographic findings in hip OA. (Cibulka et al. 2009, A8-A9) The common findings are also listed in the International Classification of Functioning, Disability and Health (ICF) -frame, which is utilized world-wide to describe the physical function of the patient (Figure 3.) (ICF 2001, Paltamaa 2008, 27).

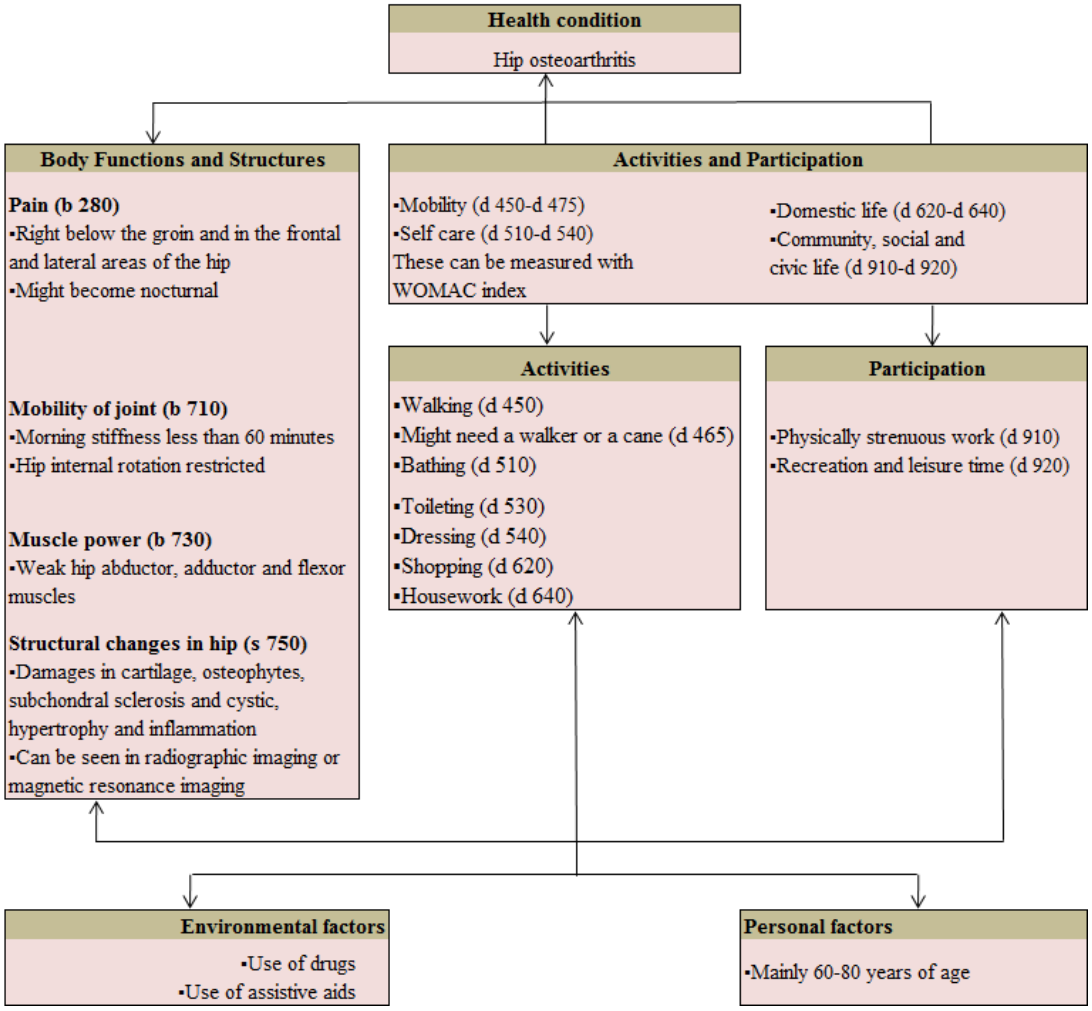

Figure 3. Physical function of hip osteoarthritis patient

Pain is the most common reason the patient seek to the physician. In the beginning pain occur in physical activities especially in strenuous activities - rest alleviates pain. Later, pain can be constant even during the night and only a slight stress might trigger it. Pain radiates to a wide area in hip OA, often right below the groin and in the frontal and lateral areas of the hip. Generally pain is a consequence of the increased pressure in the joint, illness of the synovial fluid or in the surrounding tissues. Pain leads to new, compensated, moving and walking pattern and thus to restricted movements. (Hannonen & Airaksinen 2005, 217-219; Käypä hoito – suositus 2007, 604; Vogel et al. 2003, 2) The functional disability can be measured with specific questionnaires such as 24-item disease specific Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) or Lequesne, which are formulated for knee and hip OA. (Konttinen et al. 2003, 1539)

Morning stiffness, which continues less than 60 minutes, is typical in patients with hip OA (Cibulka et al. 2009, A8). In addition, the patient might have difficulties in standing up after sitting a longer period of time or problems in walking, dressing and bathing. Clinical examinations include the assessment of walking, squatting, passive hip range of motion in flexion, extension, internal and external rotations. Often in hip OA hip internal rotation is restricted first. (Käypä hoito –suositus 2007, 604) Birrell, Croft, Cooper, Hosie, Macfarlane & Silman (2001, 506-512) tested if the new attendees in primary care having hip pain and radiographic OA have also decreased hip range of motion compared to people without radiographic hip OA. The findings showed that the greatest restriction was in the hip internal rotation movement in both severe and moderate OA, greater in the former.

Individuals having hip OA are proved to have weaker adductor-, abductor- and flexor –muscles than healthy individuals, also the activity of hip extensor, m. gluteus maximus, might be inadequate. One reason for muscle weakness might be hip pain. (Suomen Fysioterapeutit ry 2008, 6) "Most significantly, the hip abductor muscles progressively weaken in the later stages of hip OA, which may create a Trendelenberg gait pattern over time" (Cibulka et al. 2009, A6).

Radiographic hip imaging is the common way to diagnose hip OA. For example damages or decrease in the cartilage, subchondral sclerosis, osteophytes and hypertrophy or local inflammation changes on the synovial membrane can be discovered in radiographic imaging. However, joint space narrowing seems to be rather late consequence in hip OA which means that radiographic findings can only detect moderate or severe OA. Therefore, it is suggested to use gadolinium enhanced magnetic resonance imaging for detecting early stage OA. Cartilage changes can be discovered with magnetic resonance imaging even before the clinical symptoms. (Cibulka et al. 2009, A9; Jurvelin et al. 2008, 1889)

3.3 Risk factors

Risk factors can be divided into two categories; systemic and local. Systemic risk factors such as age, genetic and obesity can endanger local risk factors such as joint injury, joint malpositions, joint developmental disorders and strenuous work or physical activity. (Käypä hoito -suositus 2007, 603)

Age is the greatest risk factor in the hip OA. The risk for hip OA increases with age both in men and women; however the appearance decreases after 80 years of age (Arokoski et al. 2001, 1618). Most commonly hip OA is the disease of middle-aged and elderly over 60 years of age (Cibulka et al. 2009, A6). Although, EULAR (2005, 669) suggests the age to be over 35 years. In addition to age, there is moderate evidence that genetic factors may partly cause the development of OA, especially in the hip. However, more evidence is required to prove how genetics actually affect the development of OA. (Cibulka et al. 2009, A7; Felson et al. NIH Conference Part 1 2000, 638)

Some researchers suggest that obesity has an effect on bilateral hip OA, but because it is not as studied as the association with knee OA more researches are required. However, it is known that even small increase in weight, loads the joints, and thus "could lead to cartilage breakdown and failure of ligamentous and other structural support". (Felson et al. NIH Conference Part 1 2000, 639) According to Cibulka et al. (2009, A9) studies show contradictory evidence about the relation of body mass index and hip OA, and thus suggests that "obesity is probably associated with the progression of hip OA rather than onset".

Local cartilage damage, joint deformity or pathological loading predispose to OA. Ligament tears, constant long-term mechanical stress, genetic or long-term immobilisation might cause damage in the cartilage, which then may lead to joint malpositions and joint looseness thus increasing the risk for OA. (Jurvelin et al. 2008, 1885)

Hip fractures seem to have an effect on developing hip OA due to the changes on joint articular surface, and thus causing abnormal joint biomechanics. Previous injury in hip is also suggested to cause OA although the reason for this is not well known. Similarly, some association between hip dysplasia and OA have been found. In hip dysplasia the head of the femur and the acetabulum do not perfectly fit together. When the femur is not on its correct place, it stresses the joint affecting the deformity and therefore it might cause OA. The misalignment of the femur and acetabulum due to the previous injury can also have the same effect. (Cibulka et al. 2009, A6-A7; Cimmino & Parodi 2005, 32; Felson et al. NIH Conference Part 1 2000, 641; Vogels et al. 2003, 2) In addition, in the systematic review study Lievense, Bierma-Zeinstra, Verhagen, Verhaar & Koes (2004) found some relationship between hip dysplasia and hip OA, however due to the limited evidence no strong conclusion can be made. Many of the studies included older people, and thus the effect in younger people remains unclear. Developmental disorders such as Legg-Calvé-Perthes disease, congenital hip dislocation and cartilage damages may also lead to hip OA. (Arokoski et al. 2001, 1622)

Coggon, Kellingray, Inskip, Croft, Campbell & Cooper (1998, 524) found that men whose work included regular lifting of 10kg or more for prolonged periods had more often diagnosed with hip OA. In addition to heavy lifting, regular stair climbing showed the similar results. Professional athletes may have an increased risk to develop OA. Cimmino & Parodi (2005, 32) suggest that marathon runners have a greater risk for hip OA, whereas Cibulka et al. (2009, A7) and Felson et al. (NIH Conference Part 1 2000, 641) suggest that high-intensity activities such as American football and hockey might lead to hip OA rather than low-impact running. In addition, Macera, Hootman & Sniezek (2003, 124) in their literature review found that "runners do not have higher rate of joint degeneration than nonrunners" but high-impact physical activities might be related to OA due to the higher risk of injuries. When, low-impact, moderate-intensity (e.g. walking or bicycling) physical activities, having lower risk of injuries, is not associated with developing OA.

4 EXERCISE THERAPY

4.1 Studies of hip osteoarthritis

Although many researchers have concluded the risk factors for hip OA, no preventative treatment has been discovered. However, conservative treatment is the main area to be focused on in the management of hip OA. The aims of the treatment are pain reduction, maintenance or increase in functional ability, activity and participation, decrease and alleviation of the symptoms and thus delaying the progression of the disorder. Therefore, great attention should be directed to patient guidance, weight reduction and patient's engagement to physical activities. (Hannonen & Airaksinen 2005, 219-224; Käypä hoito –suositus 2007, 609; Vogels et al. 2003, 7)

To increase the knowledge among people, one important part of the prevention is the guidance of the patient and his significant others. It includes information about the disease and its treatment options given by health care professional. Self-management methods and health advisement with movement training may alleviate pain, increase functional ability and the quality of life. (Käypä hoito –suositus 2007, 610; Suomen Fysioterapeutit ry 2008, 7) Also, the guidance of weight reduction, good ergonomics and working positions are important. To decrease the load of the joints, low energetic diet with physical activity training is suggested for people with OA. In addition, overweight people should be instructed not to work in kneeling positions or transfer heavy items. Advice and instructions can be given verbally, manually, visually (e.g. utilising videos), via telephone or using information technology. (Hannonen & Airaksinen 2005, 219-220; Käypä hoito –suositus 2007, 609-610)

Physical activity is important in weight reduction and in prevention of biomechanical problems. According to Ottawa Panel (2005, 950) and Felson et al. (NIH Conference Part 2 2000, 729) inactivity may result in poor aerobic capacity, cardiovascular diseases, obesity, diabetes or other comorbidity problems affecting joint health, functional status, and quality of life. Therefore, every knee and hip OA patient should receive physiotherapy, which consists of individual assessment, muscle

strength, aerobic endurance, stretching (Hannonen & Airaksinen 2005, 219-220; Käypä hoito –suositus 2007, 609), balance and coordination exercises (Bartels et al. 2007, 3; Suomen Fysioterapeutit ry 2008, 7). In the following (Table 1.) can be seen the exercise effects for people with hip OA.

Table 1.

	Participants	Method	Intervention	Results	Notes
Arokoski et al., 2002	57 men aged 47-64 with and without hip OA	Compare hip muscle strength and hip cross sectional area between men with and without hip OA, 27 with hip OA, 30 healthy	The maximal isometric hip abductor, adductor, flexor and extensor strength, isokinetic flexor and extensor strength, the cross sectional area of the pelvic and thigh muscles and pain were measured in the study.	The results show that men with hip OA have weaker abduction, adduction and flexion muscle strength in both isometric and isokinetic measurements. The cross sectional area of the pelvic and thigh muscles did not differ between the groups.	
Felson et al. (NIH Conference Part 2 2000)				Muscle strength and muscular balance are important in decreasing the load, stabilizing the joint and in supporting function and independence.	
Foley et al., 2003	105 aged 50≥, with dignosed hip or knee OA, 6 drop outs of each group	Evaluate the effects of hydrotherapy and to compare gym based and hydrotherapy based strengthening programme, 35 in hydrotherapy group, 35 in gym group, 35 in control group	6w similar type of muscle strengthening programmes in water and on land three times a week 30 min / session	Significant improvements in physical function in both hydrotherapy and gym groups compared to control group, but no great differences in relation to each other	
Fransen et al., 2007	152 aged 59≥, with symptomatic hip or knee OA, 11 drop outs	Assess the effects of hydrotherapy and Thai Chi classes, 55 in hydrotherapy, 56 in Thai Chi group, 41 in control group	12w hydrotherapy or Thai Chi classes twice a week 60 min / session, follow-up after 24w	Significant improvements in Health Survey and 3 physical function tests in hydrotherapy group, Thai Chi group improved only in stair climb. Improvements maintained at follow-up.	

Fransen et al., 2010		Support the knowledge that land-based therapeutic exercise is beneficial for people with symptomatic hip OA when considering joint pain and self-reported physical function. 32 Randomized controlled trials of which 5 were included and only one study concentrated on people with hip OA alone		They discovered small effect on pain, but no improvements in self-reported physical function.	
Hannonen & Airaksinen 2005				Muscle strengthening and aerobic endurance training seem to have a great impact in pain reduction, both training forms increase functional ability.	
Hernandez-Molina et al., 2008		9 trials of which 8 were included	The studies involved exercise and control group	Therapeutic exercise has moderate effect on pain in treating hip OA	Small number of studies
Hinman et al., 2007	71 aged 50≥, with symptomatic hip or knee OA, drop outs: intervention group 1, control group 4	Assess the efficacy of aquatic physical therapy programme, 36 in intervention group, 35 in control group	6w aquatic physical therapy programme twice a week 45-60 min / session, follow-up after 12w	Slight improvements in intervention group. 84% of the participants continued aquatic exercises after the programme.	
Konttinen et al., 2003				Strengthening of quadriceps and gluteal muscles is beneficial in hip and knee OA. Weight reduction decreases the risk of knee and possibly hip OA.	
Macera et al., 2003				Physical activities seem to decrease pain, improve physical function and delay progression in people with knee OA	
Ottawa Panel 2005		609 articles of which 113 were potential and 26 RCT or CCT were ultimately used		The results are mainly of short-term RCT. Benefits are seen in pain at rest and during functional activities, knee range of motion, quadriceps femoris muscle peak torque, grip force, stride length, level of energy functional status and aerobic capacity. Also, quality of life (only statistical significance) improved during the 8-week lower extremities strengthening programme and after 18 months walking programme.	These articles mainly considered knee OA.

Tak et al., 2005	109 aged 50≥, with hip OA, 15 drop outs	Evaluate the short- and long term effects of an exercise programme, 55 in exercise group, 54 in control group	8w exercise programme once a week 60 min / session, and a home-exercise programme, ergonomic and dietary advice were provided	Pain decreased slightly in exercise group at post-test and follow-up assessment, whereas in control group pain decreased in post-test but increased in follow-up. In exercise group hip function decreased at post-test but diminished at follow-up. The exercise group also showed decreased level of self-reported disability. Quality of life changed in neither of the groups, and the body mass index remained stable during the programme, but increased in both groups in the follow-up.	
Wang et al., 2007	42 aged 40-86, with diagnosed hip or knee OA, drop outs: exercise group 1, control group 3	Evaluate the effects of aquatic exercise programme, 21 in exercise group, 21 in control group	12w aquatic exercise programme three times a week 50 min / session	Statistically significant improvements in knee and hip range of motion (except knee flexion), leg strength and aerobic endurance.	

Exercising has shown to have many benefits for people with knee OA, but National Collaborating Centre for Chronic Conditions (2008, 95-96) reminds of the lack of evidence in hip OA. Many of the studies do not reveal the proportion of people with hip OA from the people with knee OA, and neither shows the results separately from these groups. Therefore, it is difficult to assess the effect only on people with hip OA. Despite of this National Collaborating Centre for Chronic Conditions (2008, 95-96) still recommend that exercising should be "a core treatment" in treating OA. Similarly, according to Vogels et al. (2003, 10 & 25) and EULAR (2005, 673) any kind of activity which is functional and which contains muscle strengthening and loading are beneficial, despite the lack of evidence. In addition, Suomen Fysioterapeutit ry (2008, 8) suggest that results of hip OA are parallel to the results of knee OA.

Vogels et al. (2003, 10 & 25) recommend individual, group therapy and aerobic water exercises combined with other therapy methods have a positive influence on hip OA. Suomen Fysioterapeutit ry (2008, 6&9) suggest that individual or group physiotherapy supports the patient's independent exercising, and might ease joint pain, improve physical function and quality of life. Low-impact joint-friendly physical activities with no concurrent strong compression- and rotational movements are recommended due to the low risk of injuries. Also, Felson et al. (NIH Conference Part 2 2000, 729-730) suggest three different kinds of exercise therapy (muscle strengthening, aerobic endurance and range of motion exercises) to be beneficial in

OA, and adds that exercising according to various associations is beneficial when considering overall well-being.

According to Vogels et al. (2003, 10) “a minimum of six weeks treatment is advised to ensure that patients experience some benefits of treatment and undergo behavioural changes". Similarly, according to American College of Sports Medicine (ACSM) (2009, 694) in their recommendations for healthy adults suggest that muscle hypertrophy can be perceived after six weeks of training. Whereas, Ottawa Panel (2005, 950) and Suomen Fysioterapeutit ry (2008, 7) give no exact guidelines due to the inconclusive results.

It should be remembered to start exercising with cautious, gradually increasing the loading and intensity (Macera et al. (2003, 125); Ottawa Panel (2005, 950); Suomen Fysioterapeutit (2008, 9); Vogels et al. (2003, 25). In addition, for careful start, Macera et al. (2003, 125) proposes cardiovascular screening for older adults who have not been regularly active before starting to exercise, and those who have a chronic disease should only start training after medical approval. It is also highly important to know the following concerns. Physical activities, which increase severe pain or the OA symptoms, should be avoided (Käypä hoito –suositus 2007, 610; Macera et al 2003, 126). In case of inflamed joint, the loading of the joint is lightened till no inflammation exists (Suomen Fysioterapeutit ry 008, 7). Cold, elevation and compression might ease pain in acute painful phase. Also water exercises in warm pool enable to actively maintain the joint range of motion in painful inflamed and loaded joints. (Konttinen et al. 2003, 1540)

4.2 Muscle strength

Strengthening of the main muscle groups in lower limbs is important in hip OA. In addition to possible effects on pain relief and muscle strength in hip OA, for all people resistance training enhances cardiovascular function, dynamic stability, functional capacity and quality of life, prevents osteoporosis, reduces risk factors of coronary heart disease, non-insulin-dependent diabetes and possibly colon cancer and it is also beneficial in weight reduction or maintenance. (ACSM 2009, 688)

Although, this thesis concentrates on people with hip OA, it is important to be aware of some general exercise guidelines for healthy adults as well. In the following, some exercise principles are covered by ACSM (2009, 687-708). They give progression models in resistance training for healthy adults, but they remind that "recommendations should be applied in context and should be contingent up on an individual's target goals, physical capacity, and training status", as is the case with this thesis.

Progression in exercising is crucial (to improve the physical function) and it can be achieved by covering the subsequent three principles. First, progressive overload, can be attained by increasing load, the amount of repetitions, training volume (the amount of work performed during each workout, sets x reps x resistance) or by alternating repetition speed and rest period. Second, in target-specific resistance training the following aspects are considered; exercised muscles, range of motion, intensity, speed and volume of training, muscle actions and consumed energy resources. Third, periodization "entails the systematic process of altering one or more program variable(s) over time to allow for the training stimulus to remain challenging and effective." Periodization can be accomplished in three different ways; classical (for peak performance), reverse (for local muscular endurance) or undulating (for multiple fitness objectives) periodization. (ACSM 2009, 688-689)

Concentric (muscle shortening), eccentric (muscle lengthening) and isometric (no change in muscle length) are muscle actions during the exercise. Eccentric muscle actions seem to be more beneficial (less motor units, less metabolically demanding, promote hypertrophy and have delayed onset muscle soreness) than concentric or isometric actions. Generally every resistance training programme consists of concentric and eccentric muscle contractions, but ACSM also suggests including isometric muscle contractions. Definition of the optional number of sets is difficult due to the contradictory evidence. However, it seems that multiple-set resistance training is more beneficial for both untrained and trained individuals than single-set training. One to three sets per exercise is recommended for novice and older adults trainers. But, ACSM proposes that variation of training volume might be more important in exercising than the amount of sets. Unilateral, bilateral, multiple- (more effective than single-joint) and single-joint exercises are all recommended in

resistance training programme. Also, exercise order should be taken into consideration to obtain the greatest advantages of resistance training; large muscle groups should be trained over small ones, multiple-joint exercises before single-joint and high intensity exercises before low ones. (ACSM 2009, 689-692 & 699)

The intensity of the isometric muscle strength training is recommended to be 40-60% of one repetition maximum (1RM), 1 to 10 repetitions per muscle group holding the contraction 1 to 6 seconds at a time. These exercises should be done once a day. The repetitions in isotonic muscle strength training are; in low intensity (40% of 1RM) 10-15, in moderate intensity (40-60% of 1RM) 8-10 and in vigorous intensity (over 60% of 1RM) 6-8. (Käypä hoito –suositus 2007, 611) Load should be increased 2-10% of 1RM when the individual can perform on two consecutive exercise periods more repetitions than the predetermined number is. (ACSM 2009, 690) For core exercises with heavy loads it is recommended to rest 2-3 minutes between the sets, for assistance exercises the recommendation is 1-2 minutes and for older adults 1-3 minutes. (ACSM 2009, 692 & 699) Isotonic training for people with hip OA should be performed 2-3 times a week (Käypä hoito –suositus 2007, 611). Macera et al. (2003, 126) suggest strengthening exercises twice a week and ACSM (2009, 693) for healthy novice trainers and older adults 2-3 times a week.

4.3 Water exercises

It is suggested that aquatic physical therapy is beneficial over land-based physical therapy for people suffering from OA. Especially the elderly benefit from water exercises because the water provides safe environment without a risk of falling. The most beneficial in aquatic physical therapy seems to be buoyancy, which reduces loading of the joints, allows greater range of motion and enables the performance of closed kinetic chain exercises, which might be too difficult to perform on land. Furthermore, warmth and the pressure of the water are proposed to be advantageous in relieving pain, reducing swelling, facilitating movements, decreasing muscle spasms and tightness, increasing blood circulation and enhancing the quality of life. (Anttila 2009, 16-17; Hinman, Heywood & Day 2007, 33; Silva, Valim, Pessanha,

Oliveira, Myamoto, Jones & Natour 2008,13; Wang, Belza, Thompson, Whitney & Bennett 2007, 142)

4.4 Aerobic endurance

Aerobic endurance is important in preventing cardiovascular or other inactivity-related diseases, enhancing functional status and quality of life. (Felson et al. NIH Conference Part 2 2000, 729; Ottawa Panel 2005, 950) Good aerobic endurance activities are walking, bicycling, water exercises and cross-country skiing. (Käypä hoito –suositus 2007, 610; Suomen Fysioterapeutit ry 2008, 6) Cibulka et al. (2009, A17) recommend aerobic activities to be the intensity of 60-80% of the maximum heart rate and maintained for at least 20 minutes. Käypä hoito -suositus (2007, 610), instead, suggest that for the elderly patients the intensity of the training should be 40-60% of maximum heart rate, and it should last 20 to 30 minutes at a time, 3 to 5 times a week. And, according to Macera et al. (2003, 126) aerobic endurance training should be done at least 30 minutes a day, most days of the week. Suomen Fysioterapeutit ry (2008, 6&9) suggest that aerobic endurance activities are exercised together with specific hip exercises.

4.5 Stretching

Although there is no scientific evidence that stretching would help in the treatment of hip OA, it is still beneficial in maintaining or increasing the joint range of motion. (Käypä hoito –suositus 2007, 611) Overactivity or tightness of any hip joint muscle, especially m. tensor fascia latae, m. rectus femoris or m. adductor longus might increase the compression in hip joint (Suomen Fysioterapeutit ry 2008, 6). Cibulka et al. (2009, A17) suggest the stretching of hip muscles (m. iliopsoas, m. rectus femoris and hip adductors) sustaining the stretch 15 to 30 seconds, 5 to 10 times daily, but at least 3 times a week. According to Käypä hoito -suositus (2007, 611) to increase the range of motion, the static stretch should be maintained 20 to 30 seconds and performed 3 to 5 times to the same muscle group 3 to 5 times a week. Macera et al. (2003, 126) suggest that range of motion exercises should be performed daily. Felson

et al. (NIH Conference Part 2 2000, 729) remind that the flexibility exercises should be calm and controlled, not increasing pain.

5 LEARNING

The term pedagogy means the education of children, utilized by ancient Greek. The term has tried to be extended to all education, but because being a different philosophy it cannot be utilized when discussing the adult education. Therefore, a more suitable term has been created; andragogy, literally meaning the art and science of teaching adults. "In the andragogical sense, adults are those individuals who have taken on adult roles in society, whether they are the 16-year-old mother or the 87-year-old retiree." (Forrest & Peterson 2006, 113-114) This study focuses on the disorder of adults; therefore, when considering the effective teaching methods, it is necessary to concentrate on andragogy rather than pedagogy.

Four assumptions are described regarding the teaching-learning relation in andragogy. First, the learners' self-concept means that when people voluntarily enter the educational world, they expect to be treated as responsible adults, who direct their own educational experience. Second, adults bring their lifelong experience into the learning process, thus, making the teaching significant for them, by using the experiences, is important. Third, adults learn through concepts which are relevant to them, e.g. people with hip OA are interested in learning about the disorder when it is concrete for them. And fourth, orientation to learning is similar with the third assumption; adults are motivated to learn when it is applicable to their lives. (Forrest & Peterson 2006, 113-114) These four assumptions affect the motivation of the learner and thus should be taken into consideration when planning the teaching session.

Motivation derives from a word motive. Motives set and maintain a person’s direction of general behaviour. Motivation can be either intrinsic (internal pleasure and good feeling) or extrinsic (external reward). External rewards are usually

temporary and the need for those might occur often, whereas internal rewards are long-lasting and they can become permanent source of motivation. Intension to start or change the specific situation is closely related to motivation, it shows how much a person is willing to try and how hard he is ready to work to achieve his goals. Engagement to a specific goal shows how valuable and important a person experiences it, and how much he is ready to hold on to it despite of the adversities and difficulties. Thus, it is important to set realistic and adequately demanding goals to maintain the motivation. It is also significant to perceive whether the person is motivated because of the private or the social matters. (Ruohotie 1998, 36-60) Other aspects which should be considered when trying to motivate a person are age and physical and mental abilities. "The teacher's responsibility is to awaken the interest of the learner towards new information", because "motivation is needed for a person to reach a state of mind were learning can happen". (Sarpio 2009, 24-25)

Hypermedia is a computer-based environment where pictures, graphics, video/audio clips and text are designed to give information in an inspired way. Computer and hypermedia use in education has increased measurably. They provide various benefits compared to conventional learning methods (books and direct lessons), but have also some disadvantages. A hypermedia tool enables a learner to search for the information and educate oneself without being depended on a teacher/instructor or a set time and place. It gives the option to process various formats at the same time, having the possibility to learn using different senses and cognitive functions. The disadvantages a learner may come across are the difficulties in processing the great amount of information in different formats. Navigation through several buttons and symbols might be overloading and confuse easily even an experienced user. (Pazzaglia, Toso & Cacciamani 2008, 110-111) However, a significant aspect is that a hypermedia tool gives the freedom for a learner to direct his own educational experience, as the first assumption of andragogy suggests being an effective way for adults to learn.

Van Gerven, Paas, Van Merriënboer, Hendriks & Schmidt (2003, 489-505) studied the efficiency of multimedia learning into old age. They compared the training efficiency between different instructional formats (conventional, unimodal and multimedia) in both young and old adults, and also compared the results between the

groups. 60 young and 60 old adults were recruited to the study. The results show that multimedia format required the least cognitive load of all instructional formats in both groups. Also in both groups the training efficiency was highest in multimedia format. Furthermore, old adults required less training time in multimedia format than in other formats, while young utilized the most; however the time was almost equal when comparing the groups. "Although no difference in the beneficial effect of multimedia learning was found between the age groups, multimedia-based instructions seem promising for the elderly."

6 THESIS PROCESS

6.1 Process description

The idea of this thesis developed from the situation of a 32-year-old female. She describes similar symptoms of the early stages of hip OA, but is unaware of the disorder itself and the possibilities what she could do to help herself. For this, she sought advice from me. This situation initiated the process of this thesis, which is described on the Figure 4.

Figure 4. Process description

2009	**Process**
May	An idea for the topic
August	Discussions, gross ideas, mind map of the thesis
October	Nivelrikko -education by Finnish Association of Physiotherapists (FAP)
November	Forming the aim
December	Table of content, marketing ideas
2010	
January	Searching for the literature
February	Searching for the literature, writing the thesis
April	Writing the thesis
July	Writing the thesis, interview, website search for public opinions
August	Returning the thesis to get opinions, recording and editing the videos
September	Editing the videos, writing exercise instructions
October	Revising the thesis, and writing exercise instructions and general text for the tool
November	Piloting the tool, and revising the tool according to the comments
	Maturation exam and the thesis presentation
December	Graduation

6.2 Tool

The tool of the thesis includes evidence-based knowledge, information, guidance and advice what hip OA means and what the person himself is able to do with it. It includes instructions and videos of the suitable exercises for hip OA patient. The tool is based on the interview of the 32-year-old woman having the risk for developing hip OA. The following matters arouse in the interview. The reasons behind the disease, what the prognosis is and how a person herself can prevent the progression of the disease should be mentioned in the tool. In case the exercising is beneficial, the tool should include favourable exercises as a video -format. However, to keep the clear idea of a good exercise programme, not too many (20 mentioned) exercises should be suggested. Also, a short printable list of the exercises is recommended to work as a reminder. In addition, some ideas how to ease pain, and exercise and stretching recommendations during the pain phase should be advised. I designed the layout of the tool, recorded and edited the videos, took and drew the pictures and wrote the text based on the evidence-based knowledge. As I do not have the required knowledge of computer-based tools, a friend of mine, Heiko Giese, programmed the tool.

6.3 Piloting

The tool was piloted by a person having the risk for developing hip OA, a last year physiotherapy student and a senior lecturer of physiotherapy. The tool was described as clear, visually pleasant and easy to use, content was structurally built and short but comprehensive, the language utilized was understandable, movements were simple and suitable also for beginners, the possibility to choose from the great amount of exercises and the printing opportunity were also considered positive.

According to the feedback the tool was modified on the following ways. It was suggested that the instructions for exercising (rest periods etc.) would be highlighted, and that there would be examples how to arrange the exercise week schedule. Also, there was a need to emphasize that the water exercises should only be done in the water (jumps too strenuous for the OA hip joint) and that the exercises can be

performed at home instead of a gym. There was a need for instructions of the middle body control as it plays a key role in every exercise. For the practical point of view, the videos were suggested to be placed on a separate page, instead of having them all on the same page, to ensure the faster usage of the tool. In addition, some of the exercises performed in water were described as unclear, and few comments on the techniques of some exercises were given. However, only one video was filmed again in purpose of replacing two videos with incorrect technique.

7 DISCUSSION

A great attention is directed to the treatment of advanced hip OA, but prevention and treatment of early stage hip OA seems to be rather unknown among common people. Browsing Nivelklubi website, which is a forum for people who suffer from OA, few aspects can be seen. Conversations typically contains information about surgeries, discussions about "ideal" time for surgery, recommendations of good orthopaedists, comparisons of the symptoms and sharing the advice of pharmaceuticals and natural products. Some share their experiences (mostly bad) of physiotherapy. Only few chains of discussions contain tips of physical treatments, even less frequently, advice of self-performed exercises. This reveals the need to increase the awareness of how a person himself is possibly able to decelerate the progression of hip OA.

Many researches comprise knee OA, but evidence-based information of hip OA is rather difficult to find. For example Fransen et al (2009) in their review of the exercise benefits for hip OA found twenty-six randomized clinical trials of which five met the inclusion criteria and only one of these five studies considered hip OA alone. Often, the researchers have studied both knee and hip OA and the results are gathered together without a division of these osteoarthritis. Therefore, it is difficult to assess whether the collected results are mainly of knee or hip OA. Although it is suggested that the results of knee OA are parallel to hip OA and some evidence is found that exercising is beneficial in treating hip OA, more research is required.

The tool consists of evidence-based knowledge of hip, OA, OA risk factors and the various exercise videos. In my opinion videos give more extensive “picture” how to perform the exercises than a simple picture does. Shooting the videos require more accuracy than simple pictures. The correct technique needs to be ensured during the whole video, and shooting angle is suggested to be cautiously planned. Multimedia teaching method was chosen over the personally given lecture, because it ensures the possibility to return to the subject, it is easy to use and it reaches people all over the world. This tool can be marketed e.g. to people with hip OA symptoms, physiotherapy schools, physiotherapists, physicians, OA organizations, physiotherapy organizations and hospitals world-wide because the language utilized is English. The need for a Finnish version of this tool is certain, and it will probably be implemented in the near future.

This tool considers hip OA only from the exercise point of view. The therapy that physiotherapists can offer (manual and physical therapy) could be added to the tool to widen the aspects. In the future when, at least in Finland, the population is ageing and is increasingly overweight the need for also similar type of package of knee OA is a foregone conclusion.

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