completing 5 repetitions per session 5 times per week. The number of sessions per day increased also from 1 to 3 sessions. Weekly participation was monitored using exercise logs. Pain, joint stiffness and physical function were assessed through the Western Ontario and Mc-Master Universities Osteoarthritis Index (WOMAC LK3.0). The statistical differences in the baseline and post-intervention variables, between the exercise and the control groups were determined using *t*-tests for independent samples, and within each group paired *t*-tests were used to compare the variables at baseline and post-intervention. Comparisons between the home-based and nursing-based exercise groups, regarding the normality assumption, were done using the independent *t*-test or the Mann-Whitney test.

Results: In the baseline, no significant differences in pain, joint stiffness and physical functions were found between the two study groups. Although, after 8 weeks intervention the ExG showed better results than the CG for pain (CG 8.7±3.2; ExG 6.3±3.2; $p = 0.003$), joint stiffness (CG 4.6±1.5; ExG 3.2±1.5; $p < 0.001$) physical function (CG 36.2±11; ExG 26.5±12.5; $p = 0.001$) and Womac Index (CG 49.5±14.7; ExG 36±16.7; $p = 0.001$). Significant improvements in pain (25.6%, $p< 0.001$), joint stiffness (26.9%, $p< 0.001$) physical function (21.4%, $p < 0.001$) and Womac Index (22.6%, $p < 0.001$) were observed after 8 weeks of exercise program. Within CG, differences from the baseline to the post-intervention assessment were also found. Comparisons between the home-based (21.3±9.2) and nursing-based (30.7±13.4) exercise groups showed only significant difference in physical function ($p = 0.027$).

Conclusions: An 8 weeks exercise program performed even in unsupervised environments (home based) individually or in group, showed to have significant improvements in pain, joint stiffness and physical function, and might be a good alternative to organized exercise, especially for patients with impaired physical function and restricted mobility. Nevertheless, poorer physical function was found in the nursing-based subjects that probably is associated to restricted capacity to exercise.

041

RECENT KNEE JOINT BUCKLING IS NOT ASSOCIATED WITH CO-ACTIVATION OF THE HAMSTRINGS DURING ISOKINETIC QUADRICEPS ACTIVATION

N.A. Segal[1], L. Frey Law[1], K. Wang[2], J. Torner[1], C.E. Lewis[3], M. Nevitt[4], D. Felson[2]
[1]Univ. of Iowa, Iowa City, IA; [2]Boston Univ., Boston, MA; [3]Univ. of Alabama at Birmingham, Birmingham, AL; [4]Univ. of California San Francsisco, San Francisco, CA

Purpose: Co-activation of the hamstrings during quadriceps contraction is necessary to counteract the anterior pull of the quadriceps on the tibia through assisting the anterior cruciate ligament. However, older adults with knee OA, particularly those with a sense of instability, have demonstrated higher levels of co-activation than persons without OA. Knee joint buckling is a functionally significant impairment that can limit mobility and restrict participation in activities. It is possible that co-activation of the hamstrings during quadriceps activation could brace the joint, leading to less buckling or co-activation could be an ineffective compensation that occurs in people with more frequent buckling episodes. We hypothesized that in adults age 55-84 with or at high risk for knee OA, hamstrings coactivation during an isokinetic quadriceps task would be higher in those who report knee joint buckling in the prior 3 months.

Methods: Participants in the MOST study completed surface electromyography of the medial and lateral hamstring muscles during maximal isokinetic quadriceps strength testing. Mean muscle activity during each repetition was standardized by maximum agonist activation levels (% maximum). Co-activation was assessed as the median hamstring activity (% maximum) during knee extension (antagonist activity) for each muscle individually and combined, correcting for baseline error. Kellgren-Lawrence (KL) grade was determined from fixed flexion knee radiographs, alignment from full-length radiographs, and age, history of knee surgery or injury and WOMAC knee pain score from questionnaires. After confirming linearity, we used generalized estimating equations to calculate the associations between antagonist hamstring co-activation and report of knee joint buckling (ipsilaterally and in either limb), while treating participant as a repeated factor for those who contributed more than 1 limb.

Results: In 480 participants (524 limbs, 67.9% women) 65.8% had a KL grade of less than 2. The mean±SD age, BMI, peak isokinetic knee extensor and flexor strength were 61.6±7.8 years, 29.8±5.8 kg/m^2, 85.0±32.5 Nm, and 57.5±20.9 Nm, respectively. Knee joint buckling was reported in the past 3 months by 14% of participants. The sample mean±SD for participants' median percent co-activation of the hamstrings when acting as an antagonist are presented in Table 1. In unadjusted analyses, hamstring antagonist co-activation levels did not differ by report of knee joint bucking. Adjusting for age, KL grade, alignment, history of knee surgery or injury and WOMAC knee pain score confirmed no significant association between co-activation level and either ipsilateral or any knee joint buckling in the prior 3 months.

Table 1

	With Ipsilateral Buckling (N=45)	Without Ipsilateral Buckling (N=474)	p-value
Medial Hamstrings	7.3±4.7%	9.2±6.8%	0.1341
Lateral Hamstrings	19.5±10.6%	17.4±10.6%	0.1100
Combined Hamstrings	13.4±5.9%	13.3±7.5%	0.4329
	With Any Buckling (N=77)	Without Any Buckling (N=445)	p-value
Medial Hamstrings	7.9±5.2%	9.3±6.8%	0.0773
Lateral Hamstrings	18.0±10.6%	17.6±10.6%	0.7291
Combined Hamstrings	12.9±6.5%	13.4±7.5%	0.5854

Conclusions: In data collected to date, co-activation level of the hamstring muscles during isokinetic quadriceps activation does not differ between older adults in the MOST cohort with and without report of knee joint buckling in the prior 3 months.

042

EFFECTIVENESS OF VIDEO-BASED HOME EXERCISE FOR OSTEOARTHRITIS OF THE KNEE: A RANDOMIZED CONTROLLED TRIAL

H. Tohyama[1], T. Chiba[1], K. Tadano[1], K. Ikoma[1], K. Yasuda[2]
[1]Hokkaido Univ. Hosp., Sapporo, Japan; [2]Hokkaido Univ. Sch. of Med., Sapporo, Japan

Purpose: Several systematic reviews conclude that exercise therapy has beneficial effects on pain and physical function of the population with osteoarthritis (OA) of the knee. However, its positive post-treatment effects on pain and physical function declined over time. Exercise adherence has been shown to be an important predictor of long-term outcome in exercise therapy. Video media can be an effective means of delivering exercise instruction. Therefore, use of a home exercise video could enhance adherence to prescribed exercise program. No published research to date has investigated the effectiveness of a home exercise video for patients with knee OA. The purpose of this study was to investigate the effects of video-based home exercise on pain, physical function and quality of life in patients with knee OA in comparison with those of conventional quadriceps exercise.

Methods: One hundred seven subjects, aged 50 years or older with knee pain and radiographic evidence of OA (Kellgren-Lawrence Grade 2, 3, or 4) were randomized to a video-based exercise group or a control group. Subjects in the video-based exercise group received a digital video disk-based program encompassing eight types of muscle stretching, active ROM exercises, and muscle strengthening. Initially, they watched the video alongside a physiotherapist. They were then given a 30-min exercise video to take home and use it during home exercise, reinforced at a clinic visit 4 weeks later. Subjects in the control group received detailed verbal and hands-on instruction in a home-based program of a conventional quadriceps exercise program initially, reinforced at a clinic visit 4 weeks later. Subjects in both groups were evaluated after 3 and 6 months and compared with the baseline scores. Measured outcomes were self-reported exercise adherence collected from diaries, the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), 8-Item Short-Form Health Survey (SF-8), pain during walking with the visual analog scale (VAS), and the body mass index (BMI).

Results: Concerning exercise adherence, subjects in the video-based exercise group performed the prescribed exercise 5.3 times (SD 1.9) and 5.0 times (SD 2.0) in a week at 3 and 6 months, while those in the control group performed the prescribed exercise 3.9 times (SD 2.1) and 3.7 times (SD 2.4), respectively. The numbers of times in the video-based exercise group were significantly higher than those in the control group (3 months: $p<0.008$, 6 months: $p<0.017$). The video-based exercise group showed significant improvements in WOMAC, SF-8 physical component summary, and VAS scores at 3 months; improvements were still evident at 6 months,

while there were no significant improvements in scores of SF-8 mental component summary. In addition, the video-based exercise group showed significant reduction of BMI at 3 and 6 months, but the control group not. The improvements at each period in WOMAC, SF-8 physical component summary, and VAS scores were significantly greater in the video-based exercise group than in the control group, while we failed to find significant differences in the amount of BMI loss between these two groups.
Conclusions: Video-based home exercise can enhance adherence to prescribed exercise program and produce substantial improvements in pain, physical function and quality of life in patients with knee OA.

043

EFFECTS OF EXERCISE ON PROGRESSION OF OA IN KNEE JOINTS

J. Nam[1], P. Perera[1], J. Liu[1], T. Butterfield[2], S. Agarwal[1]
[1]The Ohio State Univ., Columbus, OH; [2]Univ. of Kentucky, Lexington, KY

Purpose: Physical therapies have frequently shown to delay progression of cartilage damage in osteoarthritis (OA). We and other labs have shown anti-inflammatory effects of mechanical loading in appropriate magnitudes on chondrocytes and cartilage *in vitro*. However, knowledge in the systemic effects of exercise *in vivo* is still lacking. In order to elucidate the effects of mechanical loading on the progression of OA, we carried out global analyses of gene expression in the cartilages using an animal model.
Methods: OA was induced in Sprague Dowley rats (12 to 16 wks old females, n=10/group) by intra-articular injection of mono-iodoacetate (MIA, 2 mg/50μl saline). The OA progression was morphologically and histologically monitored on days 5, 10, 15 or 21 after injection. In addition, rats were subjected to daily exercise on treadmills (12 ft/min) for 45 minutes following onset of OA for 1, 5, or 9 days. All rats were sacrificed on day 21, and femurs were extracted for morphological, histological and microarray analyses. Genome-wide gene expression of cartilages were assessed by Affimatrix Rat GeneChip 1.0 ST Arrays followed by gene expression analyses by Partek Genomic Suite and Ingenuity Pathways Analysis. Alternatively, femurs were fixed in formalin for histological analysis.
Results: MIA induced a time dependent progression of cartilage/bone damage in femur. Although cartilage lesion development was morphologically/histologically visible only after day 9 post-MIA injection, more than 1300 genes (586 upregulated and 777 downregulated) were significantly ($p<0.05$) regulated with more than 2-fold change compared to untreated control. Temporal changes of gene expression according to OA progression were clustered to 5 distinct groups of genes and analyzed for their functional implications by IPA (Fig. 1).

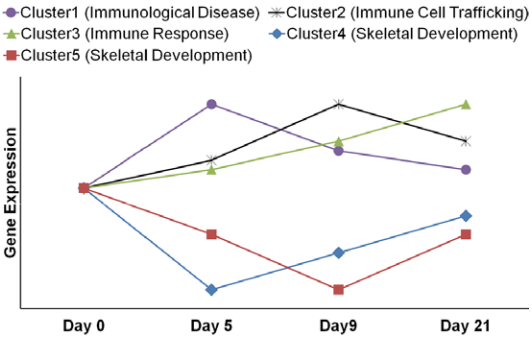

Figure 1

The clusters were groups of genes: 1) that have a peak-upregulation at day 5 after MIA injection (Cluster I - immunological disease-related); 2) that have a peak-upregulation at day 9 after MIA injection (Cluster II - immune cell trafficking-related); 3) that have a peak-upregulation at day 21 after MIA injection (Cluster III - immune response-related); 4) that have a peak-downregulation at day 5 after MIA injection (Cluster IV - skeletal development and function-related); 5) that have a peak-downregulation at day 9 after MIA injection (Cluster V - skeletal development and function-related). The subjection of rats to exercise exhibited different effects on the progression of OA depending on the initial stage of OA at the time of intervention; early intervention (1 day post-OA induction) resulted in the prevention of cartilage/bone damages while late intervention (9 day post-OA induction) induced greater cartilage/bone damage compared to non-exercised OA control (Fig. 2). Early exercise suppressed 53% of the genes that were induced by OA in the inflammatory Clusters I, II and III while upregulated 32% of the genes in the skeletal development and function-related Clusters IV and V. On the contrary, later intervention of OA with exercise (5 day post-OA induction) resulted in only 17% suppression and 7.5% upregulation in catabolic Clusters I, II, III and anabolic Clusters IV and V, respectively. Network analysis of the effects of early exercise showed that mechanical loading suppresses inflammation by downregulating NF-kB complex while promotes matrix synthesis by upregulating TGF-b activity.

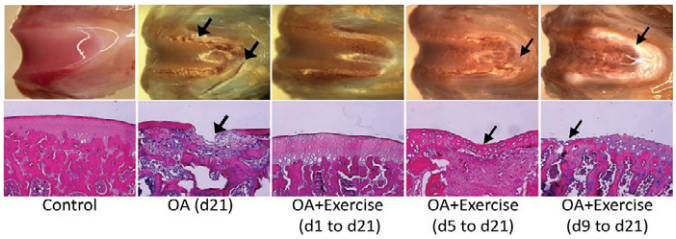

Figure 2

Conclusions: The efficacy of exercise to prevent the progression of OA is dependent on the timing of intervention. Early intervention of OA with exercise delays the disease progression by suppressing inflammation and promoting matrix synthesis while late intervention aggravates the disease.

044

A PREOPERATIVE ACTIVE REHABILITATION PROGRAM FOR PATIENTS WITH A FOCAL KNEE CARTILAGE LESION SIGNIFICANTLY IMPROVED KNEE FUNCTION AND POSTPONED THE NEED FOR CARTILAGE REPAIR SURGERY

M.A. Risberg[1,2], J.H. Røtterud[3], L. Engebretsen[4], K. Bølstad[5], A. Årøen[4]
[1]NAR, Norwegian Sch. Sport Sci., Oslo, Norway; [2]Dept. of Orthopaedic, Oslo Univ. Hosp., Oslo, Norway; [3]2Orthopaedic Dept., Akershus Univ. Hosp., Akershus, Norway; [4]Orthopaedic Dept., Oslo Univ. Hosp., Oslo, Norway; [5]NAR, Hjelp24NIMI, Oslo, Norway

Purpose: The objective of the study was to implement an active rehabilitation program to improve preoperative knee function in patients scheduled for cartilage repair surgery
Methods: Patients scheduled for cartilage repair surgery with a focal femoral condyle cartilage lesion assessed with knee arthroscopy were included. Further inclusion criteria were patients between 17 and 50 years of age, no ligament injury, and a Lysholm score of less than 75. All patients had completed a rehabilitation program prior to inclusion of the study. Outcome measurements were Lysholm score, Cinncinati score, IKDC2000, all subscales of KOOS (pain, symptoms, ADL, Sport, QOL), isokinetic quadriceps and hamstring muscle strength tests (Biodex 6000), four single leg hop tests, and the Tegner activity scale. The three months active rehabilitation program included neuromuscular and strength exercises under the supervision of a physical therapist. Each patient received a questionnaire every second week through email (Questback) to record compliance to the active rehabilitation program, in addition to a specific training diary filled in by the patients at each physical therapy visit. Patients were tested prior to start (baseline) and re-tested after the end of the three months active rehabilitation program (post rehab test). At post rehab test all patients were offered cartilage repair surgery.
Results: Forty-eight patients, 70% men, with a mean age of 34 years (±9.3 years) and a BMI of 27 (±5.0) with a cartilage lesion on the medial femoral condyle (84%), and with a mean cartilage lesion of 2.9cm^2 (1.0-6.0cm^2) were tested at baseline. Forty-two patients (88%) were tested post rehab at a mean of 103 days (±29.2 days) after baseline testing. There were significant improvements from baseline to post rehab test for the following outcome measurements: the Lysholm score with a change in score of 8.1 points (CI: 2.2-14.0, p=0.008), the Cincinnati score with a change in score of 9.2 points (CI: 4.6-13.8, p=0.0002), the IKDC2000 with a change in score of 10.7 points (CI: 5.8-15.7, $p<0.0001$), the KOOS pain with a change in score of 5.6 points (CI: 0.7-10.5, p=0.03), the KOOS symptoms with a change in score of 6.7 (CI 2.3-11.0, p=0.003), the KOOS ADL with a change in score of 5.1 points (CI: 0.1-10.1, p=0.045), the KOOS Sport with a change in score of 15.5 points (CI: 8.0-23.1, $p<0.0002$), the KOOS QOL with a change in score of 11.4 points (CI: 6.4-16.4, $p<0.0001$), the quadriceps muscle strength (injured side) with a change in peak torque of 41.2 Nm (23% improvement, CI: 30.1-51.7, $p<0.0001$), the hamstring muscle strength (injured side) with