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EFFECTIVENESS OF TECHNOLOGY ASSISTED EXERCISE COMPARED TO USUAL CARE IN TOTAL HIP ARTHROPLASTY

C.B. Juhl †, S. Roth ‡, R. Schierbeck ‡, L.N. Nielsen ‡, A.-D. Nordlien §, N.F. Hansen §, I.B. Bistrup ||, B. Svenningsen ||, U.B. Jepsen ¶, D.T. Hofland #. † *Univ. of Southern Denmark, Odense, Denmark;* ‡ *Rehabilitationcenter Sct. Lukas, Municipality of Gentofte, Denmark;* § *Rehabilitationcenter Teglporten, Municipality of Rudersdal, Denmark;* || *Rehabilitationcenter Mørkhøj, Municipality of Gladsaxe, Denmark;* ¶ *Rehabilitationcenter Møllebo, Municipality of Lyngby-Taarbæk, Denmark;* # *Rehabilitationcenter Tranehaven, Municipality of Gentofte, Denmark*

Purpose: Technology assisted exercise are increasingly used in exercise rehabilitation often without appropriate clinical evaluation. The aim of this study is to assess the effectiveness of a 6 weeks technology assisted exercise intervention (ICURA) compared to supervised group exercise twice weekly in 6 weeks in patients after total hip arthroplasty (THA).
Methods: Participants after THA admitted to post-surgery rehabilitation in 4 municipalities in Copenhagen were randomized to either ICURA or supervised group exercise for 6 weeks. The randomization used permuted blocks on 4, 6 and 8 and was stratified on municipality. The ICURA group received one supervised group session every week and was instructed to perform exercise at home using a predefined exercise program in a smartphone app. Exercise performance was monitored via sensor technology. Physical therapists monitor exercise progression on a website and adjust with the patient on the weekly session. The supervised exercise group received supervised exercise on a rehabilitation center twice weekly. Primary outcome were 10 meters walk, secondary outcomes were 30 seconds sit-to-stand, 2.45 meters "Up and Go" test and Hip disability and Osteoarthritis Outcome Score (HOOS). Difference in outcomes after 6 weeks was adjusted for baseline-score and municipality. Analysis was firstly performed as completer analysis and secondly as intention-to-treat using the baseline score carried forward (BACF). Finally the differences between the two interventions were compared to the predefined equality point, which was set at 20%.
Results: 171 THA patients were included (84 to ICURA and 87 to usual care) and 148 (71 and 77 respectively) completed the intervention. The completer analysis showed only small and not clinical relevant differences in the effect between the two interventions in 10 meters walk (−0.20 seconds 95%CI −0.66–0.26; P = 0.39), 30 seconds sit-to-stand (−0.99 times 95%CI −2.11–0.13; P = 0.08) and 2.45 meters "Up and Go" (−0.44 95%CI −0.86–−0.01; P = 0.04), where negative is in favour of the supervised exercise group.
Furthermore there were no differences in the five domains of the HOOS; pain (0.98 95%CI −2.95–4.90; P = 0.63) other symptoms (−1.56 95%CI −5.78–2.67; P = 0.47), function in daily living (1.15 95%CI −2.81–5.11; P = 0.47), function in sport and recreation (2.81 95%CI −3.19–8.81; P = 0.36) and hip related Quality of life (0.23 95%CI −5.71–6.18; P = 0.94). Similar results were seen in the intention-to-treat analysis for all the tested outcomes. The differences in effect between the two interventions were for all outcomes less than 10% as seen in Figure 1.
Conclusions: Similar effects of 6 weeks rehabilitation were seen in patients with THA receiving either ICURA or supervised group exercise. The technology assisted exercise intervention (ICURA) is equally effective alternative to supervised group exercise performed in a rehabilitation centres for patients with THA.

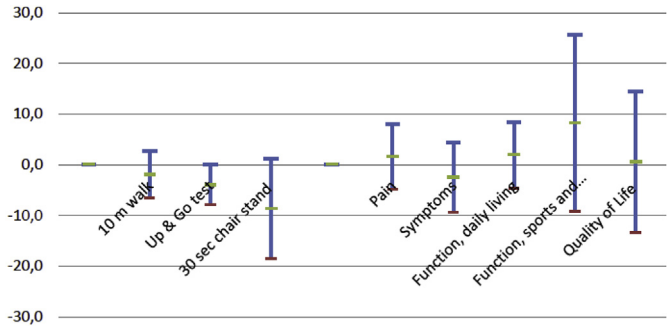

Figure. 1 Differences in percentage change after 6 weeks exercise between the technology assisted exercise intervention (ICURA) and the supervised exercise group in patients after total hip arthroplasty. Estimates below the zero-line are in favour of the supervised exercise group and estimates above favour the technology assisted exercise intervention.

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RELATIONS OF FOOT CHARACTERISTICS AND MECHANICS TO KNEE OSTEOARTHRITIS AND KNEE PAIN: A SYSTEMATIC REVIEW

R.N. Almeheyawi, J. Riskowski. *Glasgow Caledonian Univ., Glasgow, United Kingdom*

Purpose: Foot posture and foot function are hypothesised to affect aetiology of several musculoskeletal conditions in the lower limbs, such as knee osteoarthritis (OA) and knee pain. As the foot plays a major role in receiving and distributing the weight of the body, it has been a target for knee OA treatment (e.g., with orthotics), and modifiable foot factors may be a key target for reducing likelihood of these lower limb conditions or their impact. Therefore, the aim of this systematic review is to evaluate the relationship of foot characteristics and mechanics to knee pain and OA (PROSPERO reg. no. CRD42015023946).
Methods: PRISMA guidelines were followed to perform this review. Six databases (Web of Science, CINAHL, PEDro, PubMed, MEDLINE, and Physical Education Index) were searched using specific keywords and Medical Subject Headings (MeSH) terms associated with foot AND "knee osteoarthritis" OR "knee pain" to identify relevant manuscripts. Well-defined eligibility criteria were set to determine the studies for the review, which included observational or intervention studies that recruited patients with knee OA or pain who were aged 35 years or older and investigated foot characteristics in this population. Two reviewers conducted the eligibility screening and data extraction. No publication date or language restrictions were applied. Two independent reviewers evaluated the quality of the included studies based on the criteria in modified STROBE checklist including eight items. Each study was assessed and scored with one of 3 levels of quality 0, 1 or 2 according to the amount of information given for each criterion.
Results: A total of 10,594 manuscripts were found. After removing duplicates, screening by titles and abstracts, and applying the inclusion and exclusion criteria, 27 studies were eligible to be included in this review. All included studies were published between 2006 and 2015. There were 20 observational studies and seven intervention studies. For the intervention studies, baseline data were reported only. The mean age of all studies participants is 62.4 years, with the mean age of the included studies ranging from 47 to 75 years.
According to BMI (body mass index), approximately 50% of the studies included overweight participants (BMI = 25–30 kg/m2), eight studies recruited subjects with greater BMI (>30–35 kg/m2, obese I) and only one study recruited participants with BMI over 35 kg/m2, obese grade II. Outcome measurements were collected when participants were barefoot in 63% of the studies (17 studies) and were shod in 10 studies. Most of the studies (67%, 18 studies) used three-dimensional motion analysis system and force platforms whereas the rest used different tools such as foot scan, radiography and Biodex system. Eight studies measured ankle joint range of motion (ROM), four studies measured toe-out angle, two studies measured foot type (e.g., flat footedness), two studies foot function and pronation, and three studies measured 3 different outcomes: partial foot pressure per body weight, vertical navicular height, and vibratory perception threshold. Preliminary work shows ankle ROM is higher and toe-out angle is lower in patients with knee OA compared to those without OA, with further analyses underway.
Conclusions: This research exploring and evaluating the potential link between foot and knee in patients with knee OA and pain may provide a target for future interventions to reduce the likelihood of these conditions. The results of this review will expose the nature of foot characteristics in this particular population as well as will provide a better understanding of the foot and knee relationship. However, further work is necessary to understand the complex relationship between foot characteristics and knee pain and OA.

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EFFECTIVENESS OF SUPERVISED RESISTIVE EXERCISE AND HOME-BASED EXERCISE TRAINING ON LOWER LIMB MUSCLE STRENGTH IN PATIENTS WITH KNEE OSTEOARTHRITIS: A LONG-TERM COMPARATIVE STUDY

U.B. Aslan †, M.P. Kurtça †, F. Koçyiğit †, A. Koçyiğit †, E. Kuyucu ‡. † *Pamukkale Univ., Denizli, Turkey;* ‡ *Medipol Univ., Istanbul, Turkey*

Purpose: Exercise-based therapy is fundamental for the management of knee osteoarthritis (OA). Exercise is necessary for enhancing muscle strength and lower extremity multijoint strength. The objective of this study was to compare the effects of supervised resistive exercise training with home-based strength training on lower limb muscle strength in patients with knee OA.
Methods: Twenty-six patients with knee OA (Kellgren & Lawrence grade 2 or 3), aged 53,86 ± 5,33 years participated in this study. All of the patients were informed about OA risk factors, pathogenesis, prognosis, modification of daily living activities during a 2-hour long patient education lecture. Participants were then assigned at random to one of two groups as home-based strength training group (HEG) (n = 13) and resistive exercise training group (REG) (n = 13). Both exercise programs include the same or similar exercises and aimed at increasing lower limb strength (hip, knee and ankle muscles). All subjects performed three months exercise training. The subjects in the HEG were given strength exercise training and instructed to perform the exercise program three times a week for three months at home. And also, they received one session monthly supervised exercise training for progression. Progression in exercise training obtained with elastic bant. The REG received a supervised program three times a week for three months at indoor resistive exercise station. Patients in both groups performed 10 minutes warm-up period and cool-down period. The strength of quadriceps femoris, hamstrings, hip abductors, hip adductors, and gastrocnemius muscles assessed by using handheld dynamometry by the same investigator. Muscle strength of participants was assessed at baseline, 12 weeks and 24 weeks (follow-up).
Results: Four patients in the HEG dropped out during the program (one patient had humerus fracture, and three patients did not attend to scheduled follow-up). One patient in the REG was excluded because of insufficient participation in the exercise program. After exercise training period, strength of hip abductors, quadriceps femoris, gastrocnemius muscles were increased in HEG ($p < 0.05$) and strength of quadriceps femoris, hamstrings, hip abductors, hip adductors, and gastrocnemius muscles were increased in the REG ($p < 0.05$).
Conclusions: Supervised resistive exercises were more effective in strengthening lower extremity muscles when compared to home-based exercise training in patients with knee OA. However, the increase in muscle strength was not observed at long-term follow-up in both groups.

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FACET CARTILAGE FROM PATIENTS WITH LUMBAR SPINE OSTEOARTHRITIS EXHIBIT REDUCED AUTOPHAGY AND ENHANCED EXPRESSION OF CELL DEATH, INFLAMMATORY AND CATABOLIC MEDIATORS

A. Nakamura †, R. Rampersaud ‡, B. Wu †, E. Rossomacha †, S.J. Lewis ‡, M. Kapoor ‡. † *Toronto Western Res. Inst., Toronto, ON, Canada;* ‡ *Toronto Western Hosp./Univ. of Toronto, Toronto, ON, Canada*

Purpose: Specific mechanisms associated with facet cartilage degeneration during facet joint osteoarthritis (OA) are largely unknown. In this study, we obtained facet joint cartilage from patients undergoing surgery for lumbar spinal canal stenosis (LSCS) and from patients with lumbar intervertebral disc herniation (LDH) (control group) to determine the degree of facet cartilage degeneration and expression of autophagy, apoptosis, inflammatory, catabolic and anabolic markers.
Methods: The severity of degeneration in the facet joint and intervertebral disc was assessed by the MRI grading scores as described by Weishaupt et al and Pfirrmann et al, respectively. The degree of facet cartilage degeneration was further assessed histologically using the Osteoarthritis Research Society International (OARSI) grading system. Facet joint cartilage (L3 to S1; medial aspect) was collected from patients with LSCS and patients with LDH. Protein and RNA extracted from facet cartilage was subjected to quantitative real time PCR and Western blot analysis.
Results: Our results showed that all patients with LDH exhibited a degenerative score of grade 0 (normal) or grade 1, whereas all patients with LSCS exhibited scores of grade 2 or 3 for the facet joint. In the lumbar disc, all patients in both groups exhibited moderate to severe disc degeneration. Histological analysis using OARSI grading further revealed a significant degree of facet cartilage degeneration in LSCS patients (OARSI score = 5.5 + 0.2) compared to LDH patients (OARSI score = 0.9 ± 0.3). Our results further showed that LSCS facet cartilage (in comparison to the LDH control group) exhibited a significant decrease in the expression of chondroprotective autophagy markers (LC3 and ULK1), increase in mammalian target of rapamycin (mTOR, negative regulator of autophagy), increase in cell death (apoptosis) markers (PARP-1 and caspase-3), increase in inflammatory factors (IL-1β, TNF-α, IL-6, COX-2, MCP-1), increase in catabolic factors (MMP-3, MMP-13 and ADAMTS-5) and decrease in the expression anabolic matrix molecules (aggrecan and type II collagen).
Conclusions: These results clearly show that the LSCS facet cartilage exhibits an enhanced degree of facet cartilage degeneration associated with reduced expression of autophagy (chondroprotective) and anabolic markers; and enhanced expression of apoptosis, inflammatory and catabolic markers. Our uniqueness of using severely degenerated facet cartilage from patients undergoing LSCS surgery and facet cartilage from patients with LDH (as controls) allows us to understand the endogenous mechanisms associated with facet cartilage degeneration.

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THE EFFECT OF BONE MORPHOGENETIC PROTEIN-2 ON CHONDROCYTE-LIKE CELLS DERIVED FROM DEGENERATED HUMAN AND CANINE INTERVERTEBRAL DISCS

F. Bach †, A. Miranda Bedate †, F. van Heel †, M. Müller †, L. Creemers ‡, K. Ito §, K. Benz ‖, B. Meij †, M. Tryfonidou †. † *Utrecht Univ., Utrecht, Netherlands;* ‡ *Univ. Med. Ctr. Utrecht, Utrecht, Netherlands;* § *Eindhoven Univ. of Technology, Eindhoven, Netherlands;* ‖ *Univ. of Tuebingen, Reutlingen, Germany*

Purpose: Both humans and dogs experience low back pain, which is related to intervertebral disc (IVD) degeneration. Biologic repair of the degenerated IVD is mainly based on growth factors that exert anabolic matrix effects, and mesenchymal stromal cells (MSCs) to replenish the cell population of the degenerated IVD. Thus far, the anabolic effects of different growth factors have not been compared. The aim of this study was to study the effect of the frequently used growth factors transforming growth factor beta 1 (TGF-β1) and bone morphogenetic protein-2 (BMP-2) on canine and human chondrocyte-like cells (CLCs) from degenerated IVDs alone and in combination with MSCs.
Methods: CLCs from degenerated human, canine chondrodystrophic (CD) and non-chondrodystrophic (NCD) IVDs (Thompson score III) were cultured in micro-aggregates in base culture medium (negative control), or supplemented with TGF-ß1 (10 ng/mL) or BMP-2 (100 or 250 ng/mL) for 28 days. The additive effect of MSCs was studied in CD CLCs. Canine male CD CLCs were cultured in an albumin-based hydrogel (3*106 cells/mL) with or without the addition of female bone marrow-derived MSCs (BMSCs) (CLC:BMSC 1:1) in control or 250 ng/mL BMP-2-supplemented culture medium for 28 days. Read out parameters were extracellular matrix (ECM) production (RT-qPCR, glycosaminoglycan (GAG) production, Safranin O/Fast Green staining, immunohistochemistry), cell proliferation (DNA content, RT-qPCR) and apoptosis (RT-qPCR).
Results: TGF-ß1 treatment increased GAG deposition in human and canine CLC micro-aggregates, but also induced collagen type I deposition and a fibrotic rim. The latter was not observed in BMP-2-treated micro-aggregates. 250 ng/mL BMP-2 was more potent than 100 ng/mL BMP-2 in increasing GAG deposition and DNA content in canine and human micro-aggregates. Similarly, in the hydrogel culture system, BMP-2 induced GAG and collagen type II deposition and a higher DNA content compared with untreated controls. DNA and GAG content of BMSC+CLC hydrogels was higher than hydrogels with CLCs alone in the absence of BMP-2. In the BMP-2-treated hydrogels, DNA content of BMSC+CLC was higher than hydrogels with CLCs alone; GAG deposition or release was comparable between BMSC+CLC and CLC alone in the presence of BMP-2.
Conclusions: In two different 3D culture systems, BMP-2 exerted comparable regenerative effects as TGF-β1 on human and canine CLCs in terms of GAG deposition and cell proliferation, but BMP-2 did not induce fibrotic (re)differentiation as observed with TGF-ß1 treatment. Moreover, in the BMP-2-treated BMSC:CLC-containing hydrogels, where only half of the amount of CLCs were seeded compared with CLC alone, the DNA content was higher and an equal amount of GAGs was deposited, indicating that the BMSCs exerted an additional, regenerative effect in addition to BMP-2 treatment. PCR for SRY:GAPDH genes on DNA will indicate the ratio male(CLCs):female(BMSCs) present at the