

Background/Introduction: Prevention of falls accompanied by severe injuries such as fracture is of high importance for our aging society. Beyond muscle function, bone quantity and quality-indices, in particular body-control and -coordination are considered to have major impact on preventing fractures by minimizing fall-events themselves.

Purpose: Using virtual reality (VR) strategies to improve clinical parameters associated with reduced fracture risk. Recent reports indicate that specific training regimes using VR in elderly patients may lead to both mood improvement and significant advantages in balance and body control. Thus, it is becoming apparent that VR offers enormous potential for individualized, patient-centered medicine. Especially addressing the risk of shortage of critical medical supply for patients in rural areas with age-associated musculoskeletal conditions.

Methods: A Hololens-2 headsets is used to induce and monitor patient movements. The focus is on improving balance, body control and coordination in order to reduce the risk of falls. To this end, a virtual downhill skiing scenario was implemented. Patients see a target trajectory and control their motion by leaning forward, backward, or sideways to adjust speed and to steer. The course is defined such that patients have to initiate repeated, smooth body motion when following the trajectory.

Results: The software framework has been implemented and evaluated on healthy subjects. Generally, wearing the headset is tolerated well and interaction with software and motion-control was quickly learned. Active motion of the trunk and lower limbs was observed.

Conclusion(s): A VR-environment for musculoskeletal training of patients is under development. First tests indicate suitability of the system. Furthermore, it is extended to adapt to individual patient motions, to monitor and evaluate their motions with respect to improved body-balance and -control. The data will be linked to clinical data from DXA, HR-pQCT, gait and posture-analyses to analyze the musculoskeletal changes identifying the efficacy of VR in increased fracture risk cohorts.

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Risk of sarcopenia and prevention of disability in post COVID 19 elderly patients

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Background/Introduction: It is possible to improve significant activities in elderly patients by creating a link between physical ability and quality of life.

Purpose: The study evaluates the effects of combined drug treatment and occupational therapy in the basic-instrumental activities of daily life, in physical ability and in the risk for sarcopenia in post COVID 19 elderly subjects. 7 post COVID 19 elderly people (M 3, F 4, mean age 82 + 6) hosted in an Extended Care Unit were included in the study.

Methods: The design included tests performed before and after follow-up: 1) Mental State Examination (MMSE); 2) Geriatric Depression Scale (GDS); 3) Activities of Daily Living (ADL); 4) Instrumental Activities of Daily Living (IADL); 5) Short Physical Performance Battery (SPPB). The subjects of the study showed: 1) Mean MMSE score was 23.7± 8.3; 2) Mean GDS score was 13±1.8. In the group 3 subjects showed an ADL score <3, 6 had IADL <4. All subjects were specifically treated pharmacologically for comorbidities. Through SPPB evaluation we detected a mean score of 6 in physical ability. To improve ADL and IADL a 6-day-per-week occupational therapy programme was introduced. This focused on teaching patients how to compensate and adapt either physically and socially. Presence or absence of cooperation in ADL is strongly linked to the depression level.

Results: Before and after a 2-month follow-up we detected: 1) GDS score 13±1.8 vs score 8±1.7 (p<0.01); 2) ADL 3/6 score vs 5/6 score (p<0.01); 3) IADL 4/8 score vs 6/8 score (p<0.01); 4) SPPB score 6 vs 8 (p<0.01).

Conclusion(s): The combination of drug treatment and occupational therapy in post COVID 19 patients showed an improvement both in ADL and IADL. We've also linked the increased physical ability to the risk reduction of sarcopenia. The Occupational Therapist approach was customized in order to make the patients more self-assured and independent.

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Subchondral vascular modifications for hydraulic pressure load transmission and osteoarthritis

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Background/Introduction: With loading very high subchondral intraosseous pressure (IOP) occurs. Load is transferred partly by hydraulic pressure. There are previously undescribed subchondral vascular marks on MRI scans, reduced in osteoarthritis.

Purpose: We looked for structures that support load transmission by hydraulic pressure.

Methods: Normal and osteoarthritic upper tibial bone in the transverse subchondral plane was examined histologically.

Results: Radiating vessels running below the articular surface in the subchondral plane were found similar to the marks seen on MRI scans. The vessels were absent in osteoarthritic bone. Where the vessels penetrate the cortex near the joint margin there are complex choke-valve like distortions.

Conclusion(s): We confirm the presence of previously undescribed vessels running in the subchondral plane, consistent with the marks seen on MRI scans. As the vessels approach the cortical margin, complex distortions exist which may be choke-valves. With a raised surrounding IOP, they would close to prevent turbulent high-pressure flow in and out of the subchondral bone. Osteoarthritic bone had none of the longitudinal subchondral vessels or the subcortical choke valve morphological features. We suggest that osteoarthritis is associated with vasculo-mechanical failure.

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Effect of resistance training on muscle texture of the thigh as measured by MRI

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Background/Introduction: Sarcopenia is characterized by a progressive loss of skeletal muscle mass, which is infiltrated by adipose tissue (AT). Exercise can decrease the age related AT increase.

Purpose: To determine the effect of long-term high intensity resistance training (HIRT) on muscle (MT) and adipose tissue within the fascia lata.