P01

3D BIOPRINTING OF TENDON CONSTRUCTS USING BIOINKS DERIVED FROM TENDON DECELLULARIZED EXTRACELLULAR MATRIX

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Introduction: Tendon diseases are the main causes of decreased performance and early withdrawal from sport in humans and horses. Despite the improvement of therapeutic options, satisfactory tendon repair still remains a challenge. This study aimed to understand whether the application of external magnetic stimuli can affect tenogenic differentiation capacity of stem cells cultured in 3D bioprinted magnetically responsive constructs.

Method: Tendon biomimetic constructs were fabricated through 3D bioprinting, using decellularized extracellular matrices (dECM) from equine and porcine tendons as bioinks to reproduce the composition of tendon niches. Adipose derived stem cells (ASCs) were used as cell source; magnetic nanoparticles (MNP) were incorporated into the bioink to enable remote physical actuation, and then printed into a cellulose nanocrystals (CNCs) support bath, previously developed by the team. The bioprinted constructs were then cultured with or without exposure to external magnetic fields to evaluate the influence of the external stimuli on the expression of tenogenic markers (at protein and gene level) and the production of tendon-like extracellular matrix.

Results: The results of this study suggest that extracellular matrix-based bioinks of both equine and porcine tendons can be 3D bioprinted to obtain biocompatible scaffolds, that are able to induce the tenogenic differentiation of the encapsulated ASCs and the production of extracellular matrix proteins, in addition to maintain cell viability.
Conclusion: The integrated biophysical and biochemical cues, together with the applied remote magnetomechanical stimulation, revealed effective to upregulate tenogenic markers in both equine and porcine dECM-based constructs. Overall, the results show that our systems can replicate several key aspects of the developing tendon's microenvironment, thus becoming a potential strategy for treatment of tendon injuries.
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P02

A SYNTHETIC BRAIDED SCAFFOLD FOR TENDON RECONSTRUCTIVE SURGERY

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Introduction: Serious tendon injuries caused through sports or trauma often require reconstruction. Tissue engineering provides a solution with synthetic scaffolds to be used as a substitute for the donor tissue during autografting. Scaffolds can be fabricated based on requirements of injuries, degrade through biological processes during healing. This provides a structure capable of withstanding daily biomechanical forces, allowing tissue recovery. Synthetic polymers such as Polycaprolactone (PCL) have been widely explored in tissue-engineering related studies for tissues such as cartilage, ligaments, bones, and tendons. We utilized extruded filaments of PCL to form a braided structure to fabricate a tendon scaffold that closely resembles that of zone 5 digital flexor tendons.

Method: Mechanical testing and RNA expression using qRT-PCR was conducted to validate the usability of our scaffolds. Mechanical testing was conducted using an Instron 3343 mechanical tester after segmental reconstruction onto a human cadaveric zone-5 tendon. Constructs were subjected to pull-to-failure testing. Factors such as force to gap formation, breaking force, failure points and failure mechanisms were recorded. Scaffolds were seeded with adipose-derived stem cells and bone-marrow mesenchymal stem cells for the RNA expression. RNA expression of collagen, tenogenic markers, and osteogenic markers were selected.

Result: Mechanical test conducted showed a mean breaking force of 45.4N (±8.3). Failure of repair were mostly due to tendon rupture.
qRT-PCR showed expressions of COL1 and COL3, with no expressions of tenogenic markers such as DCN and TNC. There were no increased expressions of osteogenic markers.

Conclusion: We believe that our braided synthetic scaffolds made using PCL has the potential to be used in tendon segmental reconstruction. Mechanical test results showed were comparable to that of common tendon repairs, and being above requirement for early rehabilitation. The lack of tenogenic markers could be due to tenogenic expressions requiring mechanical stimulus from the environment.

P03

COMBINING BIOMIMETIC COLLAGEN/HYALURONAN HYDROGELS WITH DISCOGENIC GROWTH FACTORS PROMOTES MESENCHYMAL STROMA CELL DIFFERENTIATION INTO NUCLEUS PULPOSUS LIKE CELLS

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INTRODUCTION: Low back pain is often associated with intervertebral disc (IVD) degeneration. As an alternative to surgery, novel treatments relying on stem cells injection into Nucleus Pulposus (NP) were tested but the results were disappointing because of cell leakage and incomplete differentiation. Nowadays, a consensus exists on the necessity to encapsulate stem cells within a hydrogel to favor their differentiation. In this study, we hypothesized that mesenchymal stroma cells, encapsulated within hydrogels mimicking the NP physical properties, would differentiate into NP like cells. We also evaluated the effect of GDF-5 and TGFβ1 to potentialize the physical and biochemical stimuli.

METHOD: Hyaluronic acid (HA) was functionalized with tyramine groups (THA) and mixed with type I collagen using the 1:5 collagen/HA-Tyr ratio (collagen: 0.4%, HA-Tyr 2%). Then, human bone mesenchymal stroma cells (BM-MSCs) were added and composite hydrogels were formed. Then, cells were cultivated over 28 days with 10% fetal bovine serum (proliferation medium) or with GDF5 and TGFβ1 (differentiation medium). Pure collagen and THA hydrogels were used as controls.

RESULTS: The composite collagen/HA-Tyr hydrogels were stable over 28 days. Cell viability within pure collagen hydrogels was high but MSCs did not proliferate. In composite hydrogels, cell adhesion was lower but cells proliferate. Moreover, cells exhibited a rounded morphology similar to NP cells. The differentiation medium did not impact cell viability, mechanical properties and cell morphology. The phenotypic analysis revealed that a high THA content within hydrogels promoted the gene expression of collagen II, Sox 9 and aggrecan, three NP markers and inhibited IBSP and collagen I, osteoblast and fibroblast markers. The differentiation medium potentialized the gene expression of NP markers.

CONCLUSION: These results show that a high THA content and growth factors (GDF5 and TGFβ1) act in synergy to promote the differentiation of BM-MSCs into NP cells. Thus, these hydrogels are promising for IVD regeneration.

P04

BIOFABRICATION OF AN ACTIVE SCAFFOLD TENDON-LIKE TO OVERCOME FIBROSIS AFTER SURGICAL TENDON TEAR REPAIR.

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Introduction: Tendons and ligaments (T/L) injuries account for 50% of musculoskeletal injuries worldwide. Nowadays, T/L injuries are treated by surgical approaches, which fail to ensure appropriate biocompatibility, and mechanical resistance. Luckily, tissue engineering (TE)-based approaches relying on biocompatible scaffolds mimicking natural T/L structure offers promising alternatives. Hence, the goal of this research is to biofabricate advanced 3D scaffolds mimicking the microarchitecture and the mechanical strength of native tendons/ligaments.

Method: Post-surgical fibroses frequently lead to T/L surgery unsuccess. Starting from this evidence, we fabricated an electrospun tendon-like scaffold made of aligned poly-lactic acid (PLA) nanofibers loaded with Rolipram, an antifibrotic molecule effective in T/L. Remarkably, we coated the scaffold with type I collagen that is among the most representative components of the tendon extracellular matrix (ECM). We obtained a tendon-like structure starting from a rectangle-shaped scaffold. Then, we modelled the scaffold using a 3D-printed bundle-maker developed in house to obtain a bundle-like architecture mimicking the in vivo structure of the tendons. To evaluate the scaffold's mechanical properties and its ability to withstand physiological stresses, we performed a comprehensive mechanical characterization, including tensile and cyclic tests under dry and wet conditions.

Result: We achieved a drug-release analysis to estimate the Rolipram delivery from the scaffold. Also, we cellularized the scaffolds using human tenocytes for a preliminary cell-adhesion assessment. We observed that the collagen-coating slow down the release kinetic, and that cells arrange into an elongated shape along the nanofibers alignment.

Conclusion: This work is aimed at developing a T/L scaffold, with a midterm goal of creating an *in vitro* model to be used as a bench test for the study of tendon injury repair.
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P05

DEVELOPMENT AND VALIDATION OF CLINICALLY-RELEVANT ANIMAL MODEL OF MENISCAL DEGENERATION

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Introduction: Degenerative meniscal tears are the most common meniscal lesions, representing huge clinical and socio-economic burdens. Their role in knee osteoarthritis (OA) onset and progression is well established and demonstrated by several retrospective studies. Effective preventive measures and non-surgical treatments for degenerative meniscal lesions are still lacking, also because of the lack of specific and accurate animal models in which test them. Thus, we aim to develop and validate an accurate animal model of meniscus degeneration.

Method: Three different surgical techniques to induce medial meniscus degenerative changes in ovine model were performed and compared. A total of 32 sheep (stifle joints) were subjected to either one of the following surgical procedures: a) direct arthroscopic mechanical meniscal injury; b) peripheral devascularization and denervation of medial meniscus; c) full thickness medial femoral condyle cartilage lesion. In all the 3 groups, the contralateral joint served as a control.

Result: From a visual examination of the knee joint emerged a clear difference between control and operated groups, in the menisci but also in the cartilage, indicating the onset of OA-related cartilage degeneration. The meniscal and cartilaginous lesions were characterized by different severity and location in the different groups. For instance, a direct meniscal injury caused cartilaginous lesions especially in the medial part of the condyles, and the other approaches presented specific signature. Evaluation of scoring scales (e.g. ICRS score) allowed the quantification of the damage and the identification of differences among the four groups.

Conclusion: We were effectively able to develop and validate a sheep model of meniscal degeneration which led to the onset of OA. This innovative model will allow to test in a pre-clinical relevant setting innovative approaches to prevent meniscal-related OA.

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P06

DEVELOPMENT OF A BIOACTIVE MEMBRANE FOR POSTEROLATERAL LUMBAR FUSION

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Introduction: Posterolateral lumbar fusion surgery is applied as a therapeutic solution for lumbar degenerative diseases, in which the fusion of transversal processes of adjacent vertebrae is promoted. Osteoinductive biomaterial-based products in the market present limitations, which may include batch-to-batch variability, low pro-regenerative potential, and risk of immune rejection. To address these limitations, we developed a new osteoinductive membrane, combining calcium phosphates (β-TCP/hydroxyapatite) with hydroxypropylmethylcellulose (HPMC), with tailored bio/physicochemical properties.

Method: We used HPMC at 1wt% and tested the effect of different ceramic concentrations (0-2wt%), chemical modification (with peptides), and plasma surface treatment on the physicochemical properties of the membrane (rheometer, micro-CT, contact-angle), and its colonization (resazurin-assay, immunostaining/imaging) by bone-marrow mesenchymal stem cells (BM-MSC). The *in vitro* osteoinductive potential of the best formulation was evaluated by analysing the expression of osteogenic markers (rtPCR). The *in vivo* regenerative potential was investigated in a sheep model for 0.5, 3 and 6 months.

Result: Although the pore size-range (<250 µm) was similar for different ceramic concentrations, the 2wt% formulation presented a larger pore size range (50-200 µm), which is beneficial for bone-ingrowth and vascularization. This formulation also presented enhanced BM-MSC colonization and extracellular matrix production. Cell response was further improved by grafting the polymer with cell-adhesion RGD peptides (100µM) and by slightly increasing the hydrophilicity of the membrane´s surface by plasma-treatment. The BM-MSC cultured on optimized membranes (1wt% HPMC-RGD, 2wt% β-TCP/hydroxyapatite, plasma-treated) expressed prototypical osteogenic markers (ALP, osteocalcin, RUNX-2). When compared to a commercial material, the membrane revealed an adequate balance between rigidity and flexibility that facilitated surgical insertion and promoted better bone adhesion. After 6 months a bone bridge was formed between adjacent vertebrae.

Conclusion: The developed membrane promoted *in vitro* osteodifferentiation, *in vivo* bone formation, and adequate handling properties, showing promise as a therapeutic solution for surgical posterolateral lumbar fusion.

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P07

DLP-BASED BIOPRINTING WITH NANOMATERIAL-MODIFIED BIOINKS FOR BONE CONSTRUCTS: IMPACT ON MECHANICAL PROPERTIES AND MESENCHYMAL STEM CELL FUNCTION

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Introduction: 3D printing technologies offer a tremendous potential to produce patient-specific implants and treat critical-sized bone defects. Although progress has been made for 3D printing of biomaterial-based bone constructs, most implants are still lacking biological active material. For larger-sized bone implants, early biologization and vascularization are however essential. In this study, we established bioinks for digital light-based (DLP) bioprinting of bone constructs using methacrylated gelatine (GelMa) bioink. The bioink was modified using graphene oxide (GO) or calcium phosphate (CaP) nanomaterials to modulate the mechanical and biofunctional properties of the constructs.

Method: The bioink was developed using GelMa, a photo-initiator (Lithium-Phenyl-2,4,6-trimethylbenzoylphosphinat), a photo-absorber and further modified with CaP and GO. In the bioink human mesenchymal stem cells (hMSC) (3 x 10^6 cells/ml) were integrated. The tissue constructs were evaluated after DLP printing using DNA quantification, confocal and scanning electron microscopy, compressive strength testing, histological sections and polymerase chain reaction for osteogenic differentiation.

Result: In comparison to commercial bioinks, cell viability was higher in the established GelMa bioink. Morphological data and DNA quantification indicated the highest cell vitality, and respectively, proliferation over time in GelMa basic bioink. The incorporation of nanomaterials, CaP and GO, enhanced the functionality of the bioink in different ways, while no significant cytotoxicity was observed. CaP nanoparticles of 150 nm showed osteoinductive properties within the bioink. On the other hand, GO primarily contributed to the increase in the material's Young's modulus. Overall, in the direct comparison nanomaterials showed diverse effects in functionalizing DLP-printed bone constructs containing living osteogenic cells.

Conclusion: In conclusion, this study presents a GelMa-based bioink formulation tailored for DLP printing and enabling a high viability and biological activity of hMSC after the bioprinting process. Overall GO served as a multifunctional component with the potential to be used for further functionalization of bioinks.

P08

EARLY DEVELOPMENT OF AN ENTHESIS MODEL UTILIZING COLLAGEN FOAMS AND A NOVEL FLEXIBLE BIOREACTOR

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Introduction: The tendon-to-bone transition, or enthesis, undergoes high mechanical stresses, and the soft-to-hard tissue junction makes it prone to mechanical damage and failure. Given the current inability to properly repair tissue interfaces, *in vitro* tissue models recapitulating *in vivo* properties are fundamental to study enthesis development and repair, and for drugs and biomaterials screening. Our recently developed soft and flexible bioreactor allows for cell culture in sterile modular environments that can be compatible with commercially available actuation devices, simplifying mechanical cues introduction to the cultivated tissues. Here, we adapted the bioreactor to accommodate a collagen foam able to support osteoblasts, tenocytes and fibrochondrocytes, in the context of enthesis engineering.

Method: Primary tendon and fibrocartilage-derived cells were isolated from equine distal forelimbs and cultured in collagen foam scaffolds. Scaffolds were produced through freeze-drying and physically characterized. DNA quantification, metabolic, and Live/Dead assays were performed. Bioreactor elements were designed with CAD and 3D-printed by stereolithography.

Result: Our collagen scaffolds support cell growth and proliferation in static conditions. Early work shows an increase in cell number and metabolic activity during the initial period of culture. Foams mechanical testing indicates a 10.7±3.4% strain at break and maximum forces of 0.8±0.1N. The new bioreactor design allows for foam attachment inside the chamber through anchoring pillars inspired by previous work in ligament and bone organotypic culture.

Conclusion: The foam shows potential as scaffold for the growth of musculoskeletal cells in a soft bioreactor chamber. It shows the potential to sustain physiological strains expected in tendon tissue engineering, suggesting its suitability for future mechanical stimulation. Therefore, this scaffold could be used as a first step towards the development of an enthesis.

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P09

EFFECT OF MESENCHYMAL STEM CELLS ON SYNOVIAL BIOMARKERS OF SYNOVITIS IN HORSES

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Introduction: Constant impacts on the locomotor system of athletic horses by intense physical exercise leads to the appearance of joint injuries, as inflammation of the synovial membrane, which can progress to osteoarthritis (OA) and withdrawal from sport. The use of mesenchymal stem cells (MSCs) is gaining prominence as a treatment that seeks to modify the progression of this disease. The aim of this work was to investigate the effect of allogeneic MSCs from the synovial membrane (MSCms) on the cartilage in cases of acute synovitis in horses.

Method: Synovitis was induced using 0.5ng of LPS intra-articularly (IA) and the animals were treated 8 hours after. The control group received PBS IA, while the treated group received MSCms IA. The synovial concentration of biomarkers of synthesis and degradation of collagen (CPII and C2C), synthesis of aggrecan (CS846) and hyaluronic acid (HA) was determined through immunoenzymatic test; colorimetric detection of Thiobarbituric acid reactive substances (TBARS) was performed to observe oxidative stress.

Results: There was a significant increase in the control group in C2C levels (P= 0.015) at 24h, in TBARS levels (P=0.044) at 7 days, and in CPII (P= 0.019) and CS846 (P =0.032) at 14 days when compared to the treated group. Data analysis demonstrated an interaction between MSCs and the inflammation cycle, evidenced by the decrease in collagen degradation and by lower levels of oxidative stress in the treated group. The reduction in cartilage damage led to a lesser need for repair, demonstrated by lower levels of collagen synthesis and aggregation 14 days after the peak of inflammation.

Conclusion: The evaluated data suggest that the MSCs interacted in the maintenance of joint cartilage homeostasis, exerting an activity that resulted in less damage in the first 24 hours and, consequently, less need for repair.

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P10

EXERKINE FNDC5 PRESERVES BONE ANABOLISM AND COUNTERACTS ESTROGEN DEFICIENCY-INDUCED OSTEOPOROSIS DEVELOPMENT

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Introduction: Osteoporosis accounts for a major risk factor of fracture-associated disability or premature death in the elderly. Enhancement of bone anabolism for slowing osteoporosis is highly demanding. Exerkine fibronectin type III domain containing 5 (FNDC5) regulates energy metabolism, inflammation, and aging. This study was aimed to investigate whether Fndc5 signaling in osteoblasts changed estrogen deficiency-mediated bone loss or microarchitecture deterioration.

Method: Female osteoblast-specific Fndc5 transgenic mice (Fndc5Tg), which overexpressed Fndc5 under the control of key osteoblast marker osteocalcin promoter, were given bilateral ovariectomy to induce estrogen deficiency-mediated osteoporosis. Bone mass, microstructures, and biomechanical properties were quantified using mCT imaging and material testing. Dynamic bone formation was traced using fluorescence calcein. Osteogenic differentiation and adipocyte formation of bone-marrow mesenchymal cells were investigated using von Kossa staining and Nile red staining, respectively. Serum osteocalcin, CTX-1 and TRAP5b levels were quantified using designated ELISA kits. Mitochondrial respiration was investigated using Seahorse Extracellular Flux Analyzer.

Result: Fndc5Tg mice developed relatively higher bone mass and microarchitecture than wild-type mice. Fndc5 overexpression attenuated the losses of bone mineral density and trabecular network, including trabecular volume, thickness, and trabecular number, and improved cortical thickness and porosity in ovariectomized mice. Gain of Fndc5 function preserved biomechanical characteristics (maximum load, breaking force, and energy), serum bone formation marker osteocalcin levels, and bone formation rate, whereas it reduced serum bone resorption makers CTX-1 and TRAP5b levels, osteoclast overburden, and marrow adiposis. In vitro, Fndc5 reversed the estrogen deficiency-mediated mineralized matrix underproduction and adipocyte formation of bone-marrow mesenchymal cells, and inhibited osteoclast formation in osteoporotic bone. Mechanistically, Fndc5 activated AMPK signaling, promoting mitochondrial respiration and ATP production to enhance osteoblastic activity.

Conclusion: Fndc5 signaling exerted bone-protective actions delaying estrogen deficiency-mediated osteoporosis. This study highlighted a new molecular remedial option for osteoporosis development by manipulating Fndc5 functions.

P11

EXPLORING AN ALL-IN-ONE DECELLULARIZATION/STERILIZATION/DRYING PROCESS TO PRODUCE KNEE MENISCUS XENOGRAFT

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Introduction: Knee meniscus lesions are of outmost relevance for their high prevalence and critical impact on individuals' mobility and quality of life. Moreover, over 75% of patients with symptomatic osteoarthritis exhibit a meniscus tear. Although meniscus repair systems are the first-line treatment, 65% of meniscal tears are still deemed unrepairable and there is no current alternative. Unprecedented in its approach, we are introducing the use of supercritical carbon dioxide (scCO2) systems for the development of ALL-in-ONE tissue decellularization/sterilization/drying method to produce xenograft meniscus implants.

Method: Ovine meniscus was used as source of biological tissue. The process involved pre-processing, continuous mode decellularization with scCO2 and co-solvents (Hydrogen peroxide and ethanol), followed by sterilization and drying (DSD) under controlled temperature and pressure. Operational parameters were optimized. DSD efficacy was evaluated by histological analysis. Quantification of residual DNA was performed. Spore strips containing one biological indicator—B. stearothermophilus (steam sterilization)- was incubated. The success of sterilization was determined by evaluating the turbidity of trypticase soy broth (TSB) medium. Additionally, histological analyses utilizing Masson's Trichrome techniques was used to access extracellular matrix (ECM) preservation. Scanning electron microscopy (SEM) was used to evaluate implant integrity and *in vitro* cytotoxicity assays were performed to access biocompatibility. Lastly, mechanical properties, including standard uniaxial testing, were assessed.

Result: The results revealed that the DSD process was efficient and fast setting. The histological analysis and SEM observation showed effective cell removal and ECM preservation. The DNA quantification tests revealed a significant decrease in terms of DNA targeting value DNA<50ng/g of dry sample. Furthermore, the TSB assay showed that the samples were effectively sterilized. Lastly, the xenografts showed in vitro biocompatibility and mechanical properties resembling the native tissue.

Conclusion: The sCO2-based DSD method efficiently produced biocompatible, mechanically robust xenograft meniscus implants with preserved ECM and effective sterilization, revealing significant clinical potential.

P12

FAK ACTS ON THE PI3K/AKT/MTOR PATHWAY TO MODULATE WEAR PARTICLE-INDUCED AUTOPHAGY IN MACROPHAGES

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Introduction: Periprosthetic joint infection (PJI) is a devastating complication of total hip arthroplasty (THA) and is closely associated with innate immunity impairment. Typically, wear particles shed from the prostheses can induce abnormal autophagy of macrophages that damages the innate immunity in periprosthetic tissues. However, the underlying mechanisms remain unclear.

Method: Periprosthetic interface membranes were collected during revision THA of patients diagnosed with aseptic prosthesis loosening (APL), early-onset PJI and late-onset PJI. The autophagy marker LC3 as well as focal adhesion kinase (FAK) phosphorylation were detected. For in vitro study, autophagic activities and the FAK signal pathways in mouse macrophages was detected by Western blot/Real time qPCR. Additionally, FAK or Akt inhibitors (PF573228, MK2206) were introduced in further experiments. For in vivo study, mouse calvarial osteolysis model was established and PF573228 was injected intraperitoneally every other day for 7 and 14 days, respectively. Then calvaria were scanned and analyzed by Micro-CT. Cell autophagic activities and the expression of TNF-α as well as the activation of FAK were detected.

Result: The positive expression of autophagy markers LC3 was significantly increased in the interface membrane of patients with late-onset PJI, compared to that in the early-onset PJI group. In vitro experiments revealed that FAK activation inhibited early-stage Ti-induced autophagy via the PI3K/Akt/mTOR pathway, whereas treatment with the FAK inhibitor PF573228 recovered autophagy to a certain degree. Our mouse calvarial model also revealed that PF573228 could prevent FAK-mediated downregulation of autophagy in macrophages at the early stage and can suppress inflammation and inflammatory osteolysis.

Conclusion: FAK acts on the PI3K/Akt/mTOR pathway to modulate Ti-induced autophagy in macrophages. The use of inhibitors such as PF573228 could promote autophagy in macrophages to an appropriate level after prosthesis implantation, thereby preventing infection-related damage to periprosthetic tissues. Accordingly, FAK inhibitors can be developed as a novel therapeutic option for PJI.

P13

INVESTIGATING THE EFFECTS OF DIMETHYLOXALYLGLYCINE (DMOG) AS A POTENTIAL CIRCADIAN CLOCK-SYNCHRONIZING AGENT IN DIFFERENTIATING CHONDROCYTES

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Introduction: Hypoxia-inducible factors (HIFs) have a key role in the regulation of chondrogenesis, since oxygen pressure is relatively reduced in articular cartilage due to its avascular nature. The HIF-mediated signaling pathway can modulate the master regulatory factors of the circadian clockwork in mature chondrocytes, but the connection of the two pathways has not been investigated thoroughly in differentiating chondrocytes. Our aim was to mimic the biological impact of HIFs during in vitro cartilage formation, and investigate the effect of stabilized HIF1α expression on the molecular components of chondrogenic and circadian clock pathways.

Method: Chondrifying high density (HD) cultures were established from chondroprogenitor cells isolated from limb buds of 4.5-day-old chicken embryos. HD cultures were treated with the HIF-hydroxylase inhibitor dimethyloxalylglycine (DMOG) at different concentrations and at specific time periods. Cartilage-specific extracellular matrix alterations were detected by metachromatic dimethyl methylene blue staining. Mitochondrial activity was investigated by MTT assay. Real-time quantitative polymerase chain reaction was utilized to identify alterations in chondrogenic (SOX9, COL2A1, ACAN), circadian clock (BMAL1, PER2, CRY1), pluripotency (SOX2, SOX6), and hypoxia-related (HIF1a) mRNA expression patterns.

Result: When DMOG was applied at a 100 nM concentration for 24 hours from culturing day 0, chondrogenesis was stimulated and enhanced cartilage-specific matrix production was observed. On the other hand, treatment with more concentrated solutions of DMOG prompted the inhibition of *in vitro* cartilage formation. Circadian clockwork was positively affected when DMOG treatment was applied during the earliest stage of *in vitro* chondrogenesis: the selected marker genes showed elevated oscillation patterns in their expression levels.

Conclusion: We can conclude that pharmacological modulation of HIF-1 function has affected in vitro chondrogenesis. However, the specific downstream molecular events behind this observation will need to be studied in detail.

P14

INVESTIGATING THE IMMUNE RESPONSE TO POLY-ETHER-ETHER-KETONE PARTICLES

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Introduction: Total knee replacement (TKR) is the gold-standard treatment for patients with osteoarthritis (OA) which has progressed despite conservative intervention. Novel materials which are thought to be bio-inert and low-wearing are being trialed in TKR implants in an attempt to alleviate issues pertaining to material-associated inflammation. Poly-ether-ether-ketone (PEEK) is being tested in TKR following successful medical use in spinal fusion cages and maxillofacial reconstruction. Research is required to assess the potential pro-inflammatory responses that PEEK may elicit *in vivo* prior to the widespread use of the material in TKR implants.

Method: THP-1 macrophages were treated with 0.5-50mm^3 per cell PEEK particles which were generated using a four-station multidirectional pin-on-plate wear simulator. THP-1 cells were used in conjunction with a trypan blue exclusion assay to determine cellular viability. Cell supernatant was collected after 24-hours and used for Enzyme-linked Immunosorbent Assays (ELISA) to investigate protein secretion. Cells were lysed and RNA was extracted before cDNA synthesis was carried out in order to determine relative gene expression using Real-time Quantitative Polymerase Chain Reaction (RT-qPCR). Lipopolysaccharide was used as a positive control and untreated (UT) were used as a negative control.

Result: There was no significant change in cellular viability in the PEEK-treated cells compared to untreated at a 24-hour time point. THP-1 macrophages experienced a significant increase in the protein secretion of IL-8, IL-6, and CXCL10 following exposure to 50mm^3 per cell PEEK particles for 24 hours ($p<0.0001$). *IL-8, IL-6,* and *CXCL10* relative gene expression was also significantly upregulated in the cells exposed to PEEK particles (50mm^3 per cell) compared to UT ($p<0.0001$).

Conclusion: PEEK particles are capable of eliciting pro-inflammatory immune responses in a human macrophage model despite a lack of cytotoxicity. The pro-inflammatory responses exhibited by PEEK particle-treated cells is similar to that of other biomaterials including ceramic oxide nanopowders and cobalt-chromium used in TKR.

P15

MASQUELET TECHNIQUE USING A MOUSE FEMUR CRITICAL-SIZED BONE DEFECT MODEL - EFFECTS OF FIXATION STABILITY ON INFLAMMATORY RESPONSE AND MACROPHAGE EXPRESSION IN INDUCED MEMBRANE –

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Introduction: The crosstalk between macrophages and mesenchymal stem cells has gained attention in fracture research, leading to studies on macrophages and inflammatory responses in the Masquelet technique. This study aimed to investigate these aspects in the induced membrane.

Method: A 3-mm bone defect was created in the femurs of 24-week-old mice. Three groups were established: the Masquelet (P.M) group and the Control (P.C) group, fixed by a plate with or without a spacer in the defect, and IM.M group, fixed by an intramedullary nail with a spacer. Tissues were collected at 2 days, 1 week, 2 weeks, and 4 weeks post-surgery (n=5 per group). RT-qPCR was used to investigate macrophage and inflammatory response expression in the induced membrane. Macrophage markers iNOS (M1) and CD163 (M2), and cytokines IL1b (pro-inflammatory) and IL10 (anti-inflammatory), were evaluated.

Result: iNOS expression showed no significant differences among the groups at any time point. CD163 expression was significantly higher in the P.M group at 1week post-surgery compared to the other groups (six times higher than the P.C group and three times higher than the IM.M group). No significant differences were observed at 2 and 4 weeks. Similarly, IL1b and IL10 were significantly higher in the P.M group at 1 week compared to the other groups.

Conclusion: The differences between the P.M and P.C groups reflect a foreign body reaction at the bone defect site, suggesting that macrophages accumulating in response to the spacer enhance the inflammatory response and promote the accumulation of M2 macrophages, which play a role in tissue regeneration. The differences between the P.M and IM.M groups reflect the stability of the bone defect, indicating that adequate fixation benefits macrophage accumulation and inflammation expression in the Masquelet technique. These results provide important insights into the technique's mechanisms.

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MASQUELET TECHNIQUE: THE EFFECT OF BONE FIXATION ON INDUCED MEMBRANE PROPERTIES AND BONE HEALING IN A RAT MODEL

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Introduction: The two-stage Masquelet induced-membrane technique (IMT) consists in cement-driven membrane induction followed by bone graft into the membrane cavity to promote bone healing. The impact of the mechanical environment provided by bone stabilization during IMT stage 1 and stage 2 on the healing outcome is unknown. In an IMT rat model, we compared the effects of the mechanical environment providing low or high stability on the osteogenic and bone healing properties of induced membranes (IM).

Method: 20 male rats underwent IMT stage 1 by receiving a femoral defect stabilized with either locked internal (INT) or external (EXT) fixators providing respectively high or low mechanical stability to the defect. The defect was filled with cement to generate IM. Half of the animals was sacrificed at 4 week post-surgery to compare the osteogenic properties of INT and EXT-IMs by performing histology, BMP2 immunostaining, explant cell culture and gene expression analysis. The other 10 animals were used for IMT stage 2. Ten weeks later, bone healing efficiency was compared using micro-CT between the EXT and INT groups.

Results: Histology revealed an intensive fibrous, cell-rich and vascularized IM in both EXT and INT groups. BMP-2 was detected in all IMs from both groups but the BMP-2 positive area was slightly higher in EXT-IMs than in INT-IMs. All the EXT-IM contained MSC while they were not present in INT-IMs. The levels of *VEGF*, *IL-6*, *RUNX2* and *MMP-9* were comparable in both groups, but significant higher expressions of *IGF-1* and *HIF1a* were found in the INT-IM group. An increasing trend in bone formation in the INT group compared to the EXT group was found, although the difference was not significant.

Conclusion: Low stability seems to positively impact the IM osteogenic properties during stage 1, but a more rigid and stable fixation benefits bone defect healing in IMT stage 2.

P17

MICROFIBROUS SCAFFOLDS WITH DUAL-TRIPHASE STRUCTURAL AND COMPOSITIONAL CONFIGURATIONS MODULATE LIPID MICROENVIRONMENT FOR ENTHESIS HEALING OF A ROTATOR CUFF MODEL

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Introduction: Our study develops a novel repair approach using electrohydrodynamic (EHD) printed dual-triphase microfibrous scaffolds, designed to foster native enthesis regeneration and reduce scarring in rotator cuff injuries, which often lead to chronic discomfort and impaired shoulder function.

Method: These scaffolds are composed of polycaprolactone (PCL) with nano-hydroxyapatite, nano-magnesium oxide, and Kartogenin (KGN), targeting the osteogenic, chondrogenic, and tenogenic phases of tissue healing.

Result: The The TS+TC group's scaffolds significantly improved tissue regeneration and fibrocartilage reconstruction in rotator cuff injuries. Enhanced biomechanical properties were evidenced by increased failure loads (27.0 ± 4.2 N at 6 weeks, 32.3 ± 2.7 N at 12 weeks) and ultimate stress values. Lipidomic analyses demonstrated normalized lipid profiles, indicating a conducive healing environment. The scaffolds' microscale fibers and pores notably boosted cellular activities essential for repair, such as adhesion, proliferation, migration, and differentiation. These findings underscore the scaffolds' potential in promoting effective, organized tissue regeneration, marking a significant advancement in tissue engineering for orthopedic applications.

Conclusion: This investigation represents a pioneering application of EHD printing in tissue engineering, potentially revolutionizing rotator cuff repair strategies. The promising results from immunohistochemical and immunofluorescence analyses, coupled with advanced lipidomic profiling, suggest a paradigm shift in clinical treatments for rotator cuff injuries. The study underscores the need for further research into the long-term viability and applicability of these scaffolds across various tissue types, aiming to substantially improve patient quality of life post-surgery.

P18

P,P'-DDE FUNCTIONS IN OSTEOBLASTS TO PROMOTE BONE FORMATION VIA FOXO1-BMP4 PATHWAY

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Introduction: p,p'-Dichlorodiphenoxydichloroethylene (p,p'-DDE) is the primary metabolite of persistent organochlorine pesticide p,p'-Dichlorodiphenyltrichloroethane (DDT), which is considered to be the pollutant with high health risks in metabolic disorders such as diabetogenic effect. In this project, we aimed to test if p,p'-DDE could affect bone metabolism.

Method: Wild-type C57BL/6J Mice was treated with p,p'-DDE by oral gavage at a dose of 2 mg/kg. Ovariectomy surgery was used as osteoporosis model, and 1.8 mm bone defect was adopted on mice calvaria to make a fracture healing model. Immunoblot, IF staining, EMSA and qRT-PCR were used to study the molecular mechanisms.

Result: Low dose p,p'-DDE was used to treat mice for 8 weeks and 1 year. Surprisingly, instead of causing bone loss, p,p'-DDE increased bone mass in both young and aged (18 months old) mice. Primary osteoblasts incubated with p,p'-DDE exhibited increased mineralization at 14 days assessed by alizarin compared to controls. RNA-Seq analysis from p,p'-DDE treated osteoblasts suggested changes in the expression of CCN3 signaling pathway. p,p'-DDE induced CCN3-BMP4 expression to modulate bone formation, and the following experiment revealed FOXO1 regulated CCN3 transcription under p,p'-DDE treatment. In ovariectomy mice, p,p'-DDE rescued bone loss by adjusting FOXO1. In calvaria defect mouse model, p,p'-DDE increased fracture healing as well. In the end, human samples were tested for seum p,p'-DDE and bone mineral density (BMD). In accordance with the animal result, human with osteoporosis have lower serum p,p'-DDE levels.

Conclusion: Together, these findings reveal the function of p,p'-DDE in bone formation and the underlying mechanism, suggesting a beneficial role of p,p'-DDE in bone homeostasis and fracture healing in both animal and human.

P19

PHYSIOXIC PRECONDITIONING OF MENISCAL CELLS IN COLLAGEN SCAFFOLDS PROTECTS AGAINST CYTOKINE INDUCED MATRIX DEGRADATION

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Introduction: Cell-based therapies preserving the meniscus can prevent early osteoarthritis (OA), although inflammatory cytokine presence compromises clinical outcomes. We have demonstrated in MSC chondrogenesis that cytokine adverse effects can be countered by physioxia. In vitro studies applying the anti-inflammatory drug, celecoxib, on chondrocytes also suggest a beneficial effect on cytokine mediated matrix degradation. This study investigated whether physioxia alone or combined with celecoxib counters IL-1β effects on meniscus cells.

Method: Human avascular and vascular meniscus cells (n = 7), isolated and expanded under 20% (hyperoxia) or 2% (physioxia) oxygen were seeded into collagen scaffolds and cultured for 28 days either in the presence of either 0.1 ng/mL IL-1β, 5 µg/mL celecoxib or both under their expansion oxygen conditions. Histological (DMMB, collagen I/II immunostaining), GAG and collagen I content and gene expression (COL1A1, COL2A1, ACAN, MMP13 and ADAMTS-5) analysis were evaluated.

Result: Meniscus cells showed a donor-dependent response to physioxia with respect to GAG content. Analysis of physioxia-responsive donors, demonstrated a significant increase in GAG and decrease in collagen I content under physioxia for both meniscus cell types (*$p < 0.05$). In IL-1β treated cultures, only avascular cells had a significant increase in GAG content under physioxia compared to hyperoxia (*$p < 0.05$). Addition of celecoxib to IL-1β treated physioxic cultures showed no significant difference in GAG or collagen I content compared to physioxia alone (*$p > 0.05$). Histological staining correlated with these results, whilst gene expression showed an upregulation in COL1A1, COL2A1 and ACAN and a downregulation in MMP13 and ADAMTS5 under physioxia-responsive donors compared to corresponding hyperoxia donors.

Conclusion: Physioxia showed a donor dependent beneficial response in countering IL-1β induced matrix degradation, whilst celecoxib application did not induce a synergistic effect under the same conditions. Physioxic preconditioning prior to implantation has the potential to improve clinical outcomes for cell-based meniscus therapies.

P20

PREPARATION OF LONG DECELLULARIZED MUSCLE FIBRE BUNDLES AS SCAFFOLDS FOR TISSUE ENGINEERING

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Introduction: Skeletal muscle (SM) is a complex tissue, with a highly organized 3D structure intimately linked to its main function: generating force to produce movement. SM possesses exceptionally high regeneration capabilities, making rest and light rehabilitation sufficient to allow complete structural and functional recovery in most muscle injury cases. However, when traumatic injuries result in a substantial volumetric muscle loss (VML), the natural regeneration pathway fails at preventing irreversible loss of function. Autologous muscle grafts are the current gold standard for the treatment of VML, but they are associated with major drawbacks such as donor site availability, morbidity, and limited functionality recovery. Skeletal Muscle Tissue Engineering (SMTE) is a promising strategy to address those shortcomings. It involves bioreactor systems that apply relevant stimuli to cell-seeded scaffolds to produce healthy and functional muscle tissue. Here, we describe a scaffold preparation method that involves decellularisation of muscle tissues with physiologically relevant lengths.

Method: Swine psoas major were glycerinated to allow the dissection of thin bundles of muscle fibres. Subsequently, the fibres were decellularized through Sodium Dodecyl Sulphate (SDS) treatments. They were then thoroughly rinsed and dried overnight under vacuum. The dry fibres were re-wetted with a cell lysis buffer and the quantity of DNA extracted from each sample was characterised using the PicoGreen assay.

Result: Bundles of fibres (8-10cm in length, 2-5mm in diameter) were dissected from the bulk glycerinated muscle. In all decellularized samples, the DNA content was below the 50ng/mg of dry ECM threshold. Initial observations show that the time of SDS incubation impacts mechanical properties.

Conclusion: Preliminary results suggest that the developed method can be used to produce decellularized muscle scaffolds. Additional morphological and mechanical characterizations are ongoing, and the scaffold's ability to support cell growth will be evaluated. This data will further confirm the potential applications of this scaffold for SMTE.

P21

QUALITATIVE AND QUANTITATIVE ASSESSMENT OF THE REGENERATE BONE FORMED DURING INTRAMEDULLARY LIMB LENGTHENING USING A GOAT (CAPRINE) TIBIA MODEL. A PILOT STUDY.

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Introduction: Internal lengthening nails have become more frequently used for distraction osteogenesis. While the basic science of distraction osteogenesis using external fixation has been extensively studied, very little is known about the regenerate bone formation process using intramedullary limb lengthening techniques. The purpose of this study was to characterize the qualitative and quantitative properties of the regenerate bone formed during intramedullary limb lengthening using a goat tibia model.

Method: This was an IACUC-approved study using nine neutered male mature Spanish Cross goats. All animals had an intramedullary lengthening nail surgically inserted into the left tibiae. Following latency, 2 cm of lengthening was performed in increments of 0.25 mm three times a day. Weekly radiographs were obtained during lengthening and every 2 weeks during the consolidation phase of treatment. Tibiae were harvested after 4 weeks and 8 weeks of consolidation for different animal groups. MicroCT analysis and histologic assessments were carried out on the harvested tibiae.

Result: Based on the serial radiographs, bone formation appeared to progress from outside to the inside and from the bone ends towards the center of the regenerate. MicroCT demonstrated a cartilaginous region corresponding the fibrous interzone on the cross-sectional images. In addition, a unique cartilaginous region, similar in appearance to the interzone, adjacent to the nail within the regenerate bone is observed and described as the fibrous “innerzone”.

Conclusion: This pilot study represents the first comprehensive analysis of intramedullary distraction osteogenesis using a large animal model. It illustrates the qualitative and quantitative pattern of bone formation during distraction osteogenesis using an intramedullary lengthening nail including the discovery of a new fibrous “innerzone” not previously described in external fixation distraction osteogenesis research. This may help to explain the visual differences in regenerate bone formation seen radiographically when comparing external fixation distraction osteogenesis with internal lengthening nails.

P22

SEX BIAS IN PRECLINICAL RESEARCH ON INTERVERTEBRAL DISC DEGENERATION AND OSTEOARTHRITIS: A CROSS-SECTIONAL ANALYSIS

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Introduction: Intervertebral disc degeneration (IDD) and osteoarthritis (OA) share many similarities in the molecular processes involved in the onset and progression of these musculoskeletal pathologies. Biological sex is a risk factor for their pathogenesis, as evidenced by prevalence rates. Despite this, sex bias remains prevalent in preclinical research in the orthopaedic field and can have a huge impact on robustness and translational aspects of new findings.

Method: This study provides a comprehensive overview of how donor sex is reported in IDD and OA preclinical research using human or animal biological samples. We performed a cross-sectional analysis of original articles published in 2022 across high-impact journals in the field. The analysis aimed to determine: i) the frequency of donor sex reporting, and whether reported sex data were integrated into the analysis, and ii) journal requirements for sex reporting.

Result: Our study shows four main outcomes. First, donor sex was reported in only 61.9% of the 284 cases examined. Second, among the studies when sex was reported (176), samples were predominantly from only male donors or animals (56%). Moreover, sex was rarely incorporated as a variable in outcome analysis (3.4% of cases). Finally, although 14 out of 23 journals stipulated sex reporting requirements, 37.7% of papers published in these journals failed to report donor sex.

Conclusion: Our results provide evidence of under-reporting of sample donor sex in OA and IDD preclinical research, and the fact that sex is rarely integrated in the outcomes analysis. This discrepancy may have implications for clinical translation and can exacerbate the replication crisis. Our findings support the need for better compliance with sex reporting guidelines, which would enhance reliability and reproducibility of new studies.

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P23

SMART DRUG RELEASE SYSTEMS: HARNESSING SILICA 3D PRINTED SCAFFOLDS FOR PH-RESPONSIVE THERAPY

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Introduction: Bone has an intrinsic capability to regenerate upon injury; however, several pathologies and defect size could hamper the highly orchestrated bone formation and resorption process. For many years, growth factor and/or drug release to modulate these biological processes has been the preferred choice in the field. More recently, stimuli-responsive release has been advocated to further tune the biological response. In this sense, pH becomes acidic during some phases of bone regeneration or infections. Our study focuses on harnessing the unique potential of silica-based 3D printed scaffolds for enhancing tissue regeneration and encapsulating molecules within its mesoporosity. Moreover, silica-based 3D printed scaffolds hold significant promise in bone tissue engineering by enabling personalized scaffolds, boasting exceptional bioactivity and osteogenic characteristics.

Method: In this study, we developed a silica 3D printable material with controlled mesoporosity achieved through the sol-gel reaction of tetraethyl orthosilicate (TEOS), the addition of calcium at different concentrations as structural spacer. The developed inks were characterized in terms of printability, structure, microporosity, mechanical properties, bioactivity, drug encapsulation and release, and biocompatibility.

Result: The developed silica inks exhibited a high printability, with high shape fidelity and a proportionate contraction, while maintaining bioactivity, mechanical properties, and biocompatibility. Remarkably, the control of mesopore size significantly influenced the incorporation and release of large molecules, demonstrated using cytochrome C as a model drug. This engineered porosity enabled a pH-responsive drug release profile, exhibiting controlled release between pH 2.5 and 7.5. This pH-dependent release, influenced by the surface charge of silica at different pH levels, allowed for enhanced or minimized drug release in acidic or neutral conditions, respectively.

Conclusion: Our findings suggest that these silica-based scaffolds, with precisely controlled mesoporosity achieved through 3D printing, hold immense potential as pH-responsive platforms for bone regeneration.

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SYNTHETIC POLYDIOXANONE BASED SCAFFOLD FOR CARTILAGE REPAIR IN A SHEEP MODEL – HISTOPATHOLOGICAL EVALUATION

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Introduction: Despite the improvement of therapeutic options, satisfactory cartilage repair remains a challenging joint condition in human and animal orthopedics. This study aimed to verify the potential of a new polydioxanone synthetic (PDO) scaffold in articular cartilage repair compared to a commercially available porcine collagen I/III scaffold and microfracture alone in a study model in sheep.

Method: Chondral defects 10-mm in diameter were created in the weight-bearing center of the medial femoral condyle in both limbs of 16 adult Ile de France sheep. The animals were divided into four groups: microfracture only, microfracture with collagen I/ III, microfracture with polydioxanone scaffold and control group without treatment. The quality of cartilage repair was assessed histopathologic after 26 weeks and the synovial concentration of cartilage biomarkers such as synthesis and degradation of collagen markers, CPII and C2C respectively, synthesis of aggrecan (CS846) and hyaluronic acid (HA) were measured by immunoenzymatic test (ELISA).

Results: No adverse reactions were observed at the sheep joint using the PDO scaffold. In addition, there were no statistical differences between polydioxanone and collagen scaffolds in the histopathologic evaluation neither in the concentration of the synovial fluid biomarkers, indicating that the PDO scaffold is as safe and as effective as the well-established commercially available scaffolders.

Conclusion: The results of the study show that polydioxanone membrane is a safe scaffold that provides cell support and shows potential improvement in chondrogenic differentiation, which may improve the quality of cartilage repair. In addition, because it is made of 100% synthetic material, it can be customized to meet the needs of each patient and allows for rapid and cost-effective manufacturing.

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P25

THE POTENTIAL OF SHEEP IN PRECLINICAL MODELS FOR BONE INFECTION RESEARCH – A SYSTEMATIC REVIEW

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The potential of sheep in preclinical models for bone infection research – a systematic review
Introduction: Reliable animal models are critical for preclinical research and should closely mimic the disease. With respect to route of infection, pathogenic agent, disease progression, clinical signs, and histopathological changes. Sheep have similar bone micro- and macrostructure as well as comparable biomechanical characteristics to humans. Their use in bone research is established, however their use in bone infection research is limited. This systematic review will summarise the key features of the available bone infection models using sheep, providing a reference for further development, validation, and application.

Method: This systematic review was designed according to the PRISMA guidelines and registered with PROSPERO. Quality was assessed using SYRICLE's risk of bias tool adapted for animal studies. PubMed, MEDLINE, Web of Science and EMBASE were searched until March 2022. 1921 articles were screened by two independent reviewers, and 25 were included for analysis.

Result: Models have been developed in nine different breeds. *Staphylococcus aureus* was used in the majority of models, typically inoculating 10^8 colony forming units in tibial or femoral cortical defects. Infection was established with either planktonic or biofilm adherent bacteria, with or without foreign material implanted. Most studies used both radiological and microbiological analyses to confirm osteomyelitis.

Conclusion: There is convincing evidence supporting the use of sheep in bone infection models of clinical disease. The majority of sheep studied demonstrated convincing osteomyelitis and tolerated the infection with minimal complications. Furthermore, the advantages of comparable biology and biomechanics may increase the success for translating *in vivo* results to successful therapies.

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TUNABLE SMART BIOMATERIAL FOR CARTILAGE REGENERATION (ULTRACART REGENERA)

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Introduction: Rheumatoid Arthritis (RA) and Osteoarthritis (OA) are among the most impactful musculoskeletal disorders causing articular cartilage degradation, ultimately leading to loss of the joint functionality. Matrix-assisted Autologous Chondrocytes Implantation (MACI) is one of the most promising reconstructive techniques to treat chondral defects (CDs). MACI relies on a matrix cellularized with autologous chondrocytes implanted directly onto cartilage defects. Despite MACI's effectiveness, post-surgery rehabilitation remains a challenge, as it fails to induce the optimal mechanobiology necessary for an effective cartilage regeneration. Additionally, there is a significant patient-to-patient variability and the local loads occurring during rehabilitation might consequently vary greatly. We propose a personalized approach focused on the delivery local pro-regenerative mechanobiological cues to dramatically improve the cartilage restoration after MACI.

Method: We developed an innovative scaffold to be used as matrix in MACI, capable to enhance the cartilage repair by delivering *in situ* controlled, and personalized, mechanical cues triggering pro-regenerative cellular responses to embedded human articular chondrocytes (hACs). The scaffold relies on an electrospun matrix made of aligned fibers composed of PVDF-TrFE, a piezoelectric polymer, enriched with ferromagnetic Fe_3O_4 nanoparticles capable to confer magnetic properties to the scaffold. MNPs were simultaneously dispersed in the polymeric solution, and microfibers were collected onto a high-speed rotating collector to obtain an aligned micropattern, capable to give mechanical anisotropy to the scaffold. After cellularization with hACs, we subjected the scaffold to daily magnetic stimulation up to 14 days.

Result: hACs produced a type II collagen-rich extracellular matrix when cultured within the scaffolds subjected to magnetic stimulation. Moreover, we observed an increase of cell viability, and of type II/type X collagen ratio.

Conclusion: Our scaffold was able to provide pro-regenerative cues to hACs after mechanical cyclic deformations induced by repeated magnetic stimulations. Such approach open the way to an effective, and definitive therapeutic procedure for the treatment of chondral defects.

P27

WHARTON'S JELLY MESENCHYMAL STROMAL CELL-DERIVED EXTRACELLULAR VESICLES ATTENUATE PYROPTOSIS IN SYNOVIAL FLUID TREATED HUMAN OSTEOARTHRITIC CHONDROCYTES

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Introduction: Osteoarthritis (OA) is a predominant chronic degenerative disease exerting a deep impact on quality of life and healthcare systems. Recent evidences suggest that pyroptosis, a programmed cell death characterized by inflammatory cytokine release, may play a significant role in modulating OA pain. The aim of the study is to investigate the potential role of extracellular vesicles derived from umbilical cord Wharton's jelly (WJ-MSC EVs) in the attenuation of the pyroptotic process on human chondrocytes (hOAC) pre-treated with synovial fluid in a 3D *in vitro* model.

Method: EVs isolated by tangential filtration of the conditioned medium of WJ-MSCs were characterized for: morphology by TEM, surface markers by WB and size by NTA. Confocal microscopy was used to identify PKH26-labelled EVs and monitor their incorporation into hOACs. The hOACs from surgical waste material of patients undergoing knee replacement, expanded, encapsulated in alginate beads were pre-treated with synovial fluid for 24 h (SF) and subsequently co-incubated with WJ-MSC EVs. We examined viability (CCK-8), metabolic activity (MTT), nitrite production (Griess) activation of the pyroptotis (IF), DNA quantification (PicoGreen) and gene expression levels of extracellular matrix (ECM) components (qPCR). One-way ANOVA analysis was used to compare the groups under exam and data were expressed as mean ± S.D

Result: WJ-MSC EVs increased hOACs viability and metabolic activity. The production of nitrites is significantly decreased compared sample group treated with SF. WJ-MSC EVs inhibited inflammasomes NLRP3 (nucleotide-binding domain, leucine-rich repeat pyrin domain containing 3) activation. The ECM catabolic genes decreased compared to the inflamed SF group for ADAMTS-5 and MMP-1.

Conclusion: Our results supported the potential use of WJ-MSC EVs as a cell-free strategy for OA, overcoming the side effects of cell-therapy. Moreover, WJ-MSC EVs are able to mitigate SF-treated hOACs pyroptotic death, attenuate ECM degradation and oxidative stress counteracting the inflamed status in OA development and progression.

P28

YAP SIRNA KNOCK DOWN REDUCES IL-1B-INDUCED CHONDROCYTE INFLAMMATION

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Introduction: Joint tissues demonstrate a high sensitivity to mechanical stimuli, and mechanical loading might be a critical external factor in regulating both cartilage development and long-term functional maintenance. Yes-associated protein (YAP) is widely recognized as a mediator of mechanical stimuli in various cell types, including mesenchymal stem cells (MSCs), cancer cells and chondrocytes. Numerous studies have investigated the role of YAP in osteoarthritis (OA), revealing its function in cartilage to be controversial in both mice and rats. However, the role of YAP in human osteoarthritis remains unknown. This study aimed to identify the effect of YAP small interfering RNA (siRNA) on the response of human chondrocytes to Interleukin-1 beta (IL-1β) stimuli.

Method: Human chondrocytes were isolated from the femoral heads of patients undergoing hip replacement surgery. YAP siRNA was transfected by Lipofectamine RNAiMAX reagent. YAP expression in IL-1β-treated (10 ng/mL) chondrocytes was evaluated by immunocytochemistry and RT-qPCR. DNA content was measured by the Picogreen assay. The effect of YAP siRNA on chondrocyte inflammation was investigated by measuring IL6 and IL8 levels using ELISA, and evaluating the mRNA expression of catabolic genes, including *IL6, IL8, ADAMTS5,* and *MMP13*.

Result: YAP expression, both mRNA and protein levels, did not change in IL-1β-treated chondrocytes. Compared to the negative siRNA group, YAP siRNA knockdown decreased DNA content in IL-1β-induced chondrocytes, reduced IL6 and IL8 release, downregulated *IL6, IL8,* and *ADAMTS5* mRNA expression, but upregulated *MMP13* mRNA expression.

Conclusion: This study indicates that YAP siRNA can inhibit inflammation and proliferation in IL-1β-treated human chondrocytes.

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ZNIN2S4/AG3PO4@ZEIN FILMS AS NEW ANTIBACTERIAL MATERIALS FOR COMBATING MICROBIAL INFECTIONS

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Introduction: The abuse of antibiotics causes bacteria to become resistant to multiple drugs. More than 700,000 people die from drug-resistant pathogens every year and this number is increasing yearly. Therefore, exploring novel antibacterial agents is essential to combat pathogenic microorganisms.

Method: Zinc indium sulfide ($ZnIn_2S_4$) has the advantages of low toxicity and good stability. Ag_3PO_4 has antibacterial capacity and photocatalytic activity. This work controls the morphology of $ZnIn_2S_4$ to be flower-like to increase its active sites, adjusts the ratio of $ZnIn_2S_4$ to Ag_3PO_4 to form Z-scheme heterojunctions. Using a mixture of zein and ethyl cellulose as the substrate, different proportions of $ZnIn_2S_4$, Ag_3PO_4, ZA-20, ZA-30 and ZA-40 were designed to be added to the substrate. After being mixed homogeneously, the mixed liquid was used for electrospinning. Antibacterial and biocompatibility experiments are conducted to verify high antibacterial activity and low biological toxicity of the $ZnIn_2S_4/Ag_3PO_4$@zein films.

Result: Pure zein and Z $ZnIn_2S_4$ films did not exhibit any antibacterial activity while the $ZnIn_2S_4/Ag_3PO_4$@zein films showed obvious inhibition circles against S. aureus, P. aeruginosa, E. coli and B. subtilis. The range of inhibition increased with an increasing proportion of Ag_3PO_4, possibly because Ag^+ in the material can damage proteins in bacteria, causing irreversible damage to cell walls and membranes, resulting in the death of bacteria. Z ZA-40 had the best bacteriostatic effect with inhibition zones and had antibacterial rates against S. aureus, P. aeruginosa, E. coli and B. subtilis of 99.02%, 98.78%, 98.17% and 99.2% respectively. Even Z ZA-20, which has a poor bacteriostatic effect, can achieve an average antibacterial rate of >70.00% for the four strains.

Conclusion: Hydrothermal and in-situ precipitation methods were combined with flower-like $ZnIn_2S_4$ as the substrate and Ag_3PO_4 to form lattice-match Z-scheme heterojunctions. Different mass ratios of $ZnIn_2S_4/Ag_3PO_4$@zein films with excellent broad-spectrum antibacterial activity and biocompatibility were prepared through electrospinning technology.

P30

SAMPLE SIZE EFFECT ON MUSCULOSKELETAL SEGMENTATION

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Introduction: Artificial intelligence, especially the use of convolutional neural networks, has become a key tool in musculoskeletal medical image segmentation. It enables fast and precise delineation of bone and cartilage in medical images, greatly enhancing diagnostic and treatment planning. Recent advancements in image processing and network architecture require a reassessment of the relationship between segmentation accuracy and training data volume. This study examines the minimum sample size needed to achieve clinically relevant accuracy in bone and cartilage segmentation using the nnU-Net methodology. Additionally, the potential benefit of integrating available shape knowledge for data augmentation, a largely unexplored area in data preprocessing, is explored.

Method: The nnU-Net is a robust framework successfully applied to various biomedical segmentation tasks. This study examines the impact of sample size on the nnU-Net's segmentation accuracy using three high-quality musculoskeletal datasets of the lower limb, including MRI and CT, to segment bone and cartilage. Segmentation performance was evaluated using dice similarity coefficients and Hausdorff distance metrics. Additionally, a shape model-informed augmentation approach was explored on two datasets by generating new training samples with a shape model-informed method.

Result: Results show that the nnU-Net achieves remarkable segmentation accuracy with as few as 10–15 training samples for bones and 25–30 training samples for cartilage. The mean Dice similarity coefficients for bone segmentation ranged between 0.85 and 0.98, depending on the bone. For knee cartilage segmentation, the scores were as high as 0.87 and 0.90. Mean Hausdorff distances varied between 1.45 mm and 4.46 mm, indicating high precision. Model-informed augmentation did not significantly improve segmentation results.

Conclusion: The sample size findings challenge the common notion that large datasets are necessary for clinically relevant segmentation outcomes in musculoskeletal applications.

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THE MOST CRITICAL 2ND STABILIZER FOR PREVENTING SCAPHOLUNATE DISSOCIATION

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Introduction: Isolated injury of the scapholunate interosseous ligament (SLIL) is insufficient to produce dorsal intercalated segment instability. Static instability of the scapholunate joint may occur when the damage to the secondary stabilizers is accompanied. There is no consensus on which secondary stabilizers are most important in preventing scapholunate dissociation, but many authors have reported the importance of dorsal intercarpal (DIC), scaphotrapeziotrapezoid (STT), and long radiolunate ligament (LRL). The purpose of this study was to evaluate the role of the DIC, STT, and LRL ligaments in preventing scapholunate dissociation.

Method: Thirty fresh-frozen upper extremity cadaveric specimens (Male 10, Female 6, Ages 60~93) were prepared. A wrist simulator with a linear guide rail system (tendon load/motion-controlled system) and a motion capture system were used. The scapholunate (SL) distance, radioscaphoid angle (RSA), radiolunate angle (RLA), and scapholunate angle (SLA) were measured through continuous flexion-extension and ulnar deviation–radial deviation movements. Results were compared in five conditions: (1) intact, (2) SLIL section, (3) DIC section, (4) STT section, and (5) LRL section. Sections of the DIC, STT, and LRL ligaments were assigned in random order.

Result: Sectioning of the only SLIL was not sufficient to alter the normal kinematics of the SL joint. The SLIL+DIC section had the greatest effect on SL distance widening. According to RSA, the SLIL+STT section had a greater effect on scaphoid flexion deformity, but the difference was not significant. According to RLA, the SLIL+LRL section had a greater effect on the lunate extension deformity, but the difference was also not significant. In terms of SLA, the SLIL+DIC section had the greatest effect on SL rotation.

Conclusion: Among many secondary stabilizers, the DIC ligament had the greatest impact on the distraction and rotational strength of the SL joint. Techniques to reconstruct DIC should be considered when treating SL dissociation.

P32

PORCINE STIFLE JOINT AS A MODEL FOR HUMAN KNEE ANATOMY: DETAILED ANALYSIS AND IMPLICATIONS FOR ORTHOPAEDIC RESEARCH

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Introduction: Large animal models, particularly pigs, are widely used in research due to their anatomical and biomechanical similarities to humans, making them cost-effective for orthopaedic studies. The porcine stifle joint closely resembles the human knee joint in terms of meniscal anatomy, ligament structure, and bone composition, making it ideal for studying joint mechanics and meniscus research. This study aims to enhance anatomical data on porcine stifle joints to aid in selecting suitable animal models for research, focusing on meniscal size, volume, and dimensions.

Method: Stifle joints from male Yorkshire pigs were collected, preserved, and dissected. Detailed knee anatomy was recorded, and menisci were isolated, excised, and dried for measurements. Bone morphological dimensions were measured using a digital vernier caliper and ImageJ software. Meniscal volume was assessed using Archimedes' principle. Statistical analysis was performed using descriptive statistics and an unpaired Student's t-test.

Result: The results cover anatomical comparisons, bone and meniscus measurements, age-related effects, and statistical significance:
Anatomical Comparison: The porcine stifle joint has limited extension compared to the human knee and distinct ACL (Anterior Cruciate Ligament) and PCL (Posterior Cruciate Ligament) structures.
Bone Measurements: The porcine distal femur has an aspect ratio close to square, while the proximal tibia's aspect ratio differs from human measurements.
Meniscus Anatomy: No significant difference in width measurements between methods. Lateral menisci are significantly larger than medial menisci.
Age-Related Changes: Significant differences in bony morphology development before 3 months of age, with notable differences in NSI (Notch Shape Index) and NWI (Notch Width Index) across juvenile stages.

Conclusion: The porcine stifle joint is a suitable model for studying human knee, ACL, and meniscus treatments, offering detailed comparative anatomy and highlighting cost-effectiveness and accessibility. The study also informs model selection based on age-related anatomical changes, enhancing the utility of porcine models in orthopaedic research.

P33

A MULTIMODAL IODINATED GADOLINIUM-GOLD NANOMATERIAL AS CONTRAST AGENT FOR CARTILAGE IMAGING

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Introduction: Cartilage damage is a critical aspect of osteoarthritis progression, but effective imaging strategies remain limited. Consequently, multimodal imaging approaches are receiving increased attention. Gold nanomaterials, renowned for their therapeutic and imaging capabilities, hold promise in drug development. However, their potential for cartilage imaging is rarely discussed. Here, we developed a versatile nanomaterial, AuNC@BSA-Gd-I, for cartilage detection. By leveraging electrostatic interactions with sulfated glycosaminoglycans (sGAG), the AuNC@BSA-Gd-I can effectively penetrate damaged cartilage while accumulating minimally in healthy cartilage. This probe can be visualized or detected using CT, MRI, IVIS, and a gamma counter, providing a comprehensive approach to cartilage imaging. Additionally, we compared the imaging abilities, cartilage visualization capacities, and versatility of currently disclosed multimodal gold nanomaterials with those of AuNC@BSA-Gd-I.

Method: The physicochemical properties of nanomaterials were measured. The potential for cartilage visualization of these nanomaterials was assessed using an *in vitro* porcine model. The sGAG content in cartilage was determined using the dimethylmethylene blue (DMMB) assay to establish the correlation between sGAG concentration and imaging intensity acquired at each modality.

Results: The cartilage imaging abilities of AuNC@BSA-Gd-I for CT, MRI, and optical imaging were verified, with each imaging intensity demonstrating a strong correlation with the sGAG content (MRI; $R2=0.93$, CT; $R2=0.83$, IVIS; $R2=0.79$). Furthermore, AuNC@BSA-Gd-^{131}I effectively accumulated in defective cartilage tissue compared to healthy cartilage (23755.38 ± 5993.61 CPM/mg vs. 11699.97 ± 794.93 CPM/mg). Additionally, current gold nanomaterials excelled in individual imaging modalities but lacked effective multimodal imaging ability.

Conclusion: Compared to current multimodal gold nanomaterials, AuNC@BSA-Gd-I demonstrates the potential to image cartilage across multiple medical instruments, providing investigators with a more powerful, visible, and convenient approach to detect cartilage defects.

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APPLICATION OF THE FIBONACCI GOLDEN RATIO IN PELVIC ANATOMY: AN INNOVATIVE APPROACH TO RADIOLOGICAL IMAGING FOR ORTHOPEDIC EVALUATION

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Introduction: This study investigates the applicability of the Fibonacci golden ratio in pelvic anatomy using X-ray images to align this mathematical principle with pelvic structures for orthopedic evaluations. The goal is to assess the potential of the golden ratio to enhance diagnostic accuracy in orthopedic applications.

Method: The study included 130 pelvic X-rays analyzed to identify anatomical landmarks (iliac crests,acetabulum,pubic symphysis,and sacroiliac joints). Distances and angles between these points were measured, and circles, arcs were constructed according to the Fibonacci sequence. Statistical analyses compared these distances' ratios with the golden ratio.

Result: The distances and angles between the iliac crest, acetabulum, and pubic symphysis often displayed proportions consistent with the golden ratio. Circular patterns between these landmarks revealed geometric alignment with Fibonacci circles. The angle formed between the line from the iliac crest to the acetabulum and the line from the acetabulum to the pubic symphysis, as well as the ratio between the intertrochanteric line length and the parallel distance through the femoral head, reflected the golden ratio. Additional measurements, such as the ratio between the greater trochanter and ilioischial line, the femoral head, and distances involving the pubic symphysis and trochanters, further aligned with the golden ratio and angles. The vertical distances between the projection of the greater and lesser trochanters relative to the femoral head diameter also supported this finding. Overall, these relationships showed a consistent alignment with the golden ratio and relevant angles ($p > 0.05$).

Conclusion: This study demonstrates a significant correlation between pelvic anatomy and the Fibonacci golden ratio, suggesting that this principle can provide a new framework in orthopedic evaluations, potentially improving diagnostic accuracy and treatment strategies. Additionally, our measurements revealed that the center of the hexagon formed in all patients was located at the S2 vertebra, corresponding to the center of mass in an adult human body.

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BIOMECHANICS OF A COLLUM-FIXATED SHORT STEM IN TOTAL HIP ARTHROPLASTY.

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Introduction: Biomechanical reconstruction of the hip significantly impacts the clinical outcome and implant survival. Our knowledge is limited of the ability of neck-stabilised prostheses to restore hip biomechanics. We hypothesised that hip biomechanics, specifically leg length and global offset (GO), may be restored to an acceptable range using the Primoris™ stem.

Method: In this retrospective study, we analysed 152 patients who underwent total hip replacement (THA) using the short collum-fixated stem Primoris™.The primary outcomes were hip parameters measured by x-ray following THA using the Primoris™ stem. After surgery, the biomechanical parameters used were measured at the arthroplasty and the native contralateral side of the same x-ray. The X-rays were taken one year after the patient's surgery.1. GO.2. Leg length discrepancy (LLD).3. Neck shaft angle (NSA).

Result: We recorded an average GO of -3.4 mm (standard deviation (SD) 7.2) and an average LLD of +3.8 mm (SD 6.4). Furthermore, we registered an average 14-degree NSA increase (SD 7.4).

Conclusion: The Primoris™ neck-stabilised stem enabled hip anatomy restoration to a favourable range with respect to GO and LLD as the average difference fell within ±5 mm. However, the stem tended to be implanted in valgus.

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COMPARATIVE BIOMECHANICAL ANALYSIS OF SUPERIOR CAPSULAR RECONSTRUCTION (SCR) AND LOWER TRAPEZIUS TRANSFER (LTT) IN TREATING MASSIVE ROTATOR CUFF TEARS

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Introduction: Treatment strategies for irreparable Massive Rotator Cuff Tears (MRCTs) are debatable, especially for younger, active patients. Superior Capsular Reconstruction (SCR) acts as a static stabilizer, while Lower Trapezius Transfer (LTT) serves as a dynamic stabilizer. This study compares the biomechanical effectiveness of SCR and LTT, hypothesizing that their combination will enhance shoulder kinematics.

Methods: Eight human shoulders from donors aged 55-75 (mean = 63.75 years), balanced for gender, averaging 219.5 lbs, were used. Rotator cuff and deltoid tendons were connected to force sensors through a pulley system, with the deltoid linked to a servohydraulic motor for dynamic force measurement.

Results: From intact to MRCT, deltoid force was reduced by 28% ($p = 0.023$). LTT increased deltoid force by 27.25 ($p = 0.166$). SCR decreased deltoid force by 34% ($p = 0.208$). Combining LTT with SCR increased deltoid force by 32.57% compared to SCR ($p = 0.023$) and decreased it by 13.6% compared to LTT alone ($p = 0.017$). Combined LTT and SCR reduced deltoid force by 20.9% from the control ($p = 0.001$). Subacromial contact pressure rose by 15% in MRCT over intact, but LTT decreased it by 7.6%, achieving nearly 50% correction. SCR increased subacromial space volume, raising pressure by 6.5%. The humeral head translation (HHT) increases with MRCT, reaching 3.33 mm (SD = 0.95) at 0 degrees, compared to 2.24 mm (SD = 0.78) in the intact. LTT and the combined LTT + SCR significantly reduce HHT, with combined LTT + SCR achieving HHT of 2.24 mm (SD = 0.63) at 0 degrees, comparable to the control.

Conclusion: Notable changes in deltoid force were observed. LTT outperformed the combined SCR and LTT in reducing deltoid force and subacromial peak pressure. Both SCR and LTT corrected HTT, with LTT being more effective. However, combining SCR and LTT optimally corrected HHT.

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DOES LATERAL CORTICAL NOTCHING FACILITATE DYNAMIZATION OF PROXIMAL FEMORAL NAILING? -A FINITE ELEMENT ANALYSIS

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Introduction: Nonunions are frequently occurring after nailing of trochanteric fractures. Dynamization of proximal femoral nail (PFN) by removal of distal interlocking is one of the recommended treatment options. In certain inter-/subtrochanteric fractures, gliding of the nail along the femoral shaft is blocked by lateral femoral cortical support of the lag screw. For these cases, lateral cortical notching (LCN) has been recommended, in which the supporting lateral bone is removed. This study investigates the biomechanical effect of LCN on gliding of the PFN and stress distribution at the bone/implant interface.

Method: In a finite-element-analysis, a 3D model of an unstable intertrochanteric fracture with PFN without distal interlocking was simulated. A synthetic femur was scanned, reconstructed and segmented. The femoral condyles were aligned parallel to the x-axis and y-axis and the femoral shaft was orientated parallel to the z-axis. An unstable intertrochanteric fracture was created. To simulate LCN, the lag screw hole was lengthened to 15.34mm. Displacement of the nail along the femoral shaft axis and von Mises stress distribution were compared between LCN model and standard implantation model.
All materials were assumed to be isotopic and homogenous with a linear elastic behaviour.

Result: Displacement of the nail along the femoral shaft axis was higher in the LCN model than in the standard model (0.48mm vs. 0.07mm). Von-Mises-stresses of 176-178 MPa at the implant and of 52-81 MPa at the proximal femur were detected. Maximum von-Mises-stresses of the implant were comparable at all sides, except for a reduced von-Mises-stress at the lateral inferior side in the LCN model.

Conclusion: Lateral cortical notching facilitates gliding of a distally-dynamized proximal femoral nail along the femoral shaft axis in intertrochanteric fractures. Additionally, the lack of lateral cortical bone support at the lag screw reduces von-Mises-stress at the bone/implant interface and could lower the risk for peri-implant fractures.

P38

EXPERIMENTAL CHARACTERISATION AND PHENOMENOLOGICAL MODELLING OF BIODEGRADABLE BIOMEDICAL FIBRES FOR ACL RECONSTRUCTION

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Introduction: Electrospinning is a robust method for fabricating biomedical fibres by stretching a charged viscoelastic polymer solution using an electric field. During electrospinning, fibres in the micro- to nano-scale range are continuously deposited onto a collecting device leading to an interconnected non-woven mesh. Traditionally, meshes are generated by collecting fibres using static collectors, such as, plates, drums, bars, discs, and funnels, however these are limited in their ability to scale-up production for commercial applications. In recent years, Mouthuy and collaborators have developed a new automated technique in which fibres are deposited onto a continuous guiding wire to produce electrospun filaments. The filaments can further be processed into braided structures with tailorable mechanical properties, which can be used as scaffold for tissue engineering applications such as tendons and ligaments repair. However, the mechanical and degradation behaviour of this novel biomaterial scaffold has not been characterised.

Method: In this work, we examine the mechanical properties of electrospun polycaprolactone (PCL) filaments through thermo-mechanical testing and constitutive phenomenological modelling. Uniaxial monotonic, cyclic, and stress relaxation tests were conducted, along with (in-situ) SEM characterisation of the porous microstructure.

Result: Experimental results reveal that filaments display viscoelastic-viscoplastic behaviour with pronounced post-yield hardening at large deformations, which correlates with the straightening of the fibres at the microscale. Our study also emphasises the role of the testing grips (screw-side or bollard grips) on the apparent material response.

Conclusion: A large strain viscoelastic-viscoplastic constitutive model was developed, which can capture the material response up to large deformations. Micro-mechanisms underpinning the macroscopic response are examined and discussed.

Keywords: Electrospinning, Viscoelasticity, Viscoplasticity, Constitutive Modelling.

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MECHANICAL STRESS AND FAILURE PATTERNS IN ADOLESCENT PORCINE ACLS: ANALYZING STRAIN AND LOAD EFFECTS UNDER CYCLIC LOADING

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Introduction: Studying Anterior Cruciate Ligament (ACL) biomechanics in human adolescents is challenging due to the scarcity of cadaveric specimens. This study aims to establish the adolescent porcine stifle joint as a viable model for ACL research. The objective is to explore the biomechanical response of porcine ACLs in adolescents under controlled cyclical loading, culminating in load-to-failure tests.

Methods: 40 fresh porcine stifle joints, with avg weight of 90 lbs, and aged 2-4 months were used. These were randomly assigned into four groups. Before testing, the joints were preserved at -22 °C and thawed at room temperature for 24 hours. The control group was subjected only to a load-to-failure test. The other groups underwent cyclical loading of 100, 250, and 500 cycles at 300N intensity. The stifle joints were dissected to isolate the ACL, and meniscus, then tested in a material testing machine (MTS, Eden Prairie/MN, USA), aligning the tibia's longitudinal axis at a 20-degree angle between the femur and tibia.

Results: In cyclic tests, energy dissipation decreased from 43.17±17.06 N/mm initially to 11.39±6.68 N/mm by the 500th cycle, a drop of 73.61%, with a strain plateau after 50 cycles. Load-to-failure tests showed the control group's force was 1034 ± 308 kN, with no significant change at 100 cycles, but significant reductions at 250 and 500 cycles, indicating ACL damage through fiber tearing. Data analysis used descriptive statistics, the Shapiro-Wilk test for normality, and one-way ANOVA with Tukey HSD for cycle effects on ACL failure.

Conclusion: The study highlights how increased cyclic loading can intensify micro-fatigue and micro-fractures in ACLs, potentially hastening injury onset. This understanding can enhance ACL injury prevention and treatment strategies in orthopaedics and sports medicine.

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OPTIMIZING PATIENT-SPECIFIC BONE FINITE ELEMENT ANALYSIS: MESH CONVERGENCE AND MATERIAL GROUPING STRATEGIES

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Introduction: Patient-specific biomechanical modeling using Finite Element Analysis (FEA) is pivotal for understanding the structural health of bones, optimizing surgical procedures, assessing outcomes, and validating medical devices, aligning with guidance issued by standards and regulatory bodies. Accurate mapping of image-to-mesh-material is crucial given bone's heterogeneous composition. This study aims to rigorously assess mesh convergence and evaluate the sensitivity of material grouping strategies in quantifying bone strength.
Method:
Subject-specific geometry and nonlinear material properties were derived from computed tomography (CT) scan data of one cadaveric human vertebral body. Linear tetrahedral elements with varying edge lengths between 2mm and 0.9mm were then generated to study the mesh convergence. To compare the effectiveness of different grouping strategies, three approaches were used: Modulus Gaping (a user-defined absolute threshold of Young's modulus ranging from 500 MPa to 1 MPa), Percentual Thresholding (relative parameter thresholds ranging from 50% to 1%), and Adaptive clustering (unsupervised k-means-based clustering ranging from 10 to 200 clusters). Adaptive clustering enables a constant number of unique material properties in cross-specimen studies, improving the validity of results.

Result: Mesh convergence was evaluated via fracture load and reached at a 1mm mesh size across grouping strategies. All strategies exhibit minimal deviation (within 5%) from individually assigned material parameters, except Modulus Gaping, with a 500 MPa threshold (32% difference). Computational efficiency, measured by runtime, significantly improved with grouping strategies, reducing computational cost by 82 to 94% and unique material count by up to 99%.

Conclusion: Different grouping strategies offer comparable mesh convergence, highlighting their potential to reduce computational complexity while maintaining accuracy in the biomechanical modeling of bones and suggesting a more efficient approach than individual element materials. The higher efficiency of FEA may increase its applicability in clinical settings with limited computational resources. Further studies are needed to refine grouping parameters and assess their suitability across different subjects.

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RADICAL SALVAGE BONE RESECTIONS IN LOWER EXTREMITIES: 30-DAY COMPLICATIONS RATES ACROSS AGE/TRANSFUSION/LENGTH OF STAY

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Introduction: In oncological orthopedic surgery, radical salvage bone resections in lower extremities are crucial for preserving limb function amidst the challenges posed by severe bone malignancies. These procedures, addressing rare and intricate conditions, aim to optimize patient outcomes while navigating the complexities of bone cancer treatment. Understanding complication rates associated with these procedures across different age groups, transfusion requirements, and lengths of stay is essential for enhancing patient care and surgical outcomes.

Methods: This retrospective analysis utilized data from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database spanning from 2017 to 2021. Patient information was extracted using specific CPT codes related to radical resections of tumors in various lower extremity locations. Complications, ranging from superficial infections to septic shock, were investigated. The final analysis included 501 cases of radical salvage resections for bone malignancies.

Results: The study cohort comprised 245 males and 256 females, with a mean age of 51.2 ± 19.1 years (range: 18 to 89 years). The overall complication rate was calculated at 28.9%, with a total of 18 varied complications reported in NSQIP. Curve fit regression tests revealed that increasing age, transfusion products, and length of stay were associated with a higher risk of complications ($P<0.001$). ROC analysis identified more than 1 unit of transfusion and post-5th day length of stay as cutoff points for increased complication risk ($P<0.001$), while the cutoff for age was not calculated ($P=0.689$).

Conclusion: In conclusion, We found that increasing age, higher transfusion requirements, and prolonged length of stay were significantly associated with an elevated risk of complications. These findings highlight the need for tailored perioperative management strategies to mitigate complications and improve surgical outcomes in this patient population.

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READMISSION AND MORTALITY AFTER MAJOR LOWER LIMB AMPUTIONS, BEFORE AND AFTER IMPLEMENTATION OF THE SAFE JOURNEY PROGRAM

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Introduction: Patients discharged after a Major Lower Extremity Amputations are in high risk for readmissions and 1 year mortality is high. The patients are fragile and suffering from a variety of comorbidities like diabetes, arteriosclerosis, cardiovascular disease and the majority are receiving anticoagulation therapy. The Safe Journey Program was implemented at hospital Lillebelt in 2019, an integrated care program offering the patients to be followed home, by the hospital nurse, daily visits from the home care nurses the first week and additional visits from the acute team members for objective evaluation of the patient de first 2 weeks after discharge. In this study we will explore the readmission rate and mortality, before and after implementation of the Safe Journey Program for Major Lower Extremity Amputation patients.

Material and methods: Medical charts from amputee patients was reviewed from 2015-2016 and compared to the data from the Safe Journey database. 142 patients was included in the study, and 81 patients received the Safe Journey intervention. Patient demographics, amputation levels, comorbidities, readmission and mortality were evaluated and data was analyzed using STATA.

Results: 130 patients was discharged after a Major Lower Extremity Amputation from 2015-2016. 142 patients was discharged after a Major Lower Extremity Amputation from 2019-2021 and 81 of them received the Safe Journey Intervention. Patient demographics, including the indication for surgery was similar, from the 2 periods. The 30 days readmission rate before the program was 14% and during the program 16%. Mortality rates was also found to be similar.

Conclusion: Patients discharged after a Major Lower Extremity Amputation are complex patients, with a high need observation. Implementing the Safe Journey program at discharge was costly, but beneficial to the patients, on a psychological level. The program was unable to reduce the 30-day readmissions rate and reduce mortality, compared to a data-set from 2015.

P43

REASONS FOR CANCELLATION OF TOTAL KNEE REPLACEMENT SURGERY IN THE UNITED KINGDOM

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Introduction: Single centre studies report total knee replacement (TKR) cancellation rates of 5-30%; one UK study reports 26%. Many occur at short notice, for avoidable medical reasons. This can have a negative impact on patient well-being and may result in losses of over £6700 in National Health Service (NHS) tariff income per cancellation.

Cancellations could be decreased by proactively identifying issues, managing expectations about the potential for cancellation, information signposting, facilitating medical optimisation, and raising issues in advance.

We aimed to identify reasons for TKR cancellations in the UK.

Method: Routinely collected data on reasons for TKR surgery cancellation were requested from six NHS hospitals, including timing of cancellation.

Where reasons were not explicit, such as 'patient unfit', medical notes were consulted to establish the specific clinical reason.
Data was coded into categories, then compiled and analysed using descriptive statistics.

Result: A total of 9403 cancellations occurred at six UK hospitals over five years (2018-2023), approximately 25-75% of procedures performed. Variability in reporting between Trusts precludes certainty about incidence rates. Cancellation categories were institutional (57%, n=5403), patient preference (24%, n=2248) and clinical (18%, n=1712). Reasons were missing for 0.4% (n=40).

Most occurred more than one week before the scheduled date (52%, n=4852). The remainder (48%, n=4297) occurred at ≤7 days. Dates were missing for 3% (n=254).

A quarter of cancellations were at short notice, on the day of or before surgery (25%, n=2390). The majority of short notice reasons were bed not available and 'patient unfit', with most clinical reasons being cardiac, wound, infection, or medication not stopped.

Conclusion: Cancellation of TKR surgery is more common than previously reported and often for avoidable clinical reasons. There is a need for provision of care pathways to provide optimisation, monitoring and information to prevent cancellations.

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AGE-RELATED VARIATIONS IN HEMOGLOBIN LEVEL REDUCTION POST-TOTAL KNEE REPLACEMENT: A MULTICENTER ANALYSIS OF CONTRIBUTING FACTORS

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Introduction: Total Knee Replacement (TKR) is aimed at enhancing mobility in osteoarthritis patients. However, the majority of TKR patients are elderly, often burdened with comorbidities, and may struggle with postoperative complications associated with TKR. Intra-operative blood loss, a significant complication, can exacerbate cardiovascular issues. This study focuses on evaluating factors leading to hemoglobin (Hb) drop post-TKR.

Method: This prospective study was conducted over six months among patients undergoing elective TKR for primary osteoarthritis at three tertiary care centers. Data on demographics, comorbidities, preoperative and postoperative Hb levels, and surgical details were collected. Multivariate regression analysis was performed using SPSS version 23.

Result: 116 patients (age range 55-80, majority female) underwent TKR, with a mean Hb drop of 2.4%. Patients over 60 experienced a higher mean Hb drop (9.65%) compared to younger patients (3.12%; p=0.001). Regression analysis revealed surgery duration as a significant factor for Hb drop in older patients (standardized coefficient beta 0.456, p=0.015).

Conclusion: Age is a significant factor in Hb level reduction following TKR, especially for those over 60. In addition, prolonged surgery duration is associated with greater Hb drops. These findings emphasize the need for tailored surgical approaches and efficient time management in TKR, particularly for elderly patients, to reduce blood loss and optimize postoperative outcomes.

P45

AN ULTRA-SHORT STEMLESS FEMORAL HIP PROTHESIS- A 10 YEAR FOLLOW UP

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Introduction: The demand for Total Hip Arthroplasty (THA) is rising and the proportion of younger patients (< 60 year old) is also increasing. These patients could face the risk of revision over time due to stress shielding in the proximal femur using standards stems. We have previously shown promising results regarding bone preservation and implant migration with an ultra-short implant after two and five years. The aim of this study was to analyse restoration of hip biomechanics and evaluate bone mineral density, implant stability and clinical outcome after 10 years follow up.

Method: In this study from 2011-2013, fifty younger patients with end-stage osteoarthritis, and normal femoral anatomy received the ultra short hip implant. Biomechaninical parameters were measured from x-rays. Bone mineral density (BMD) was measured using dual x-ray absorptiometry(DXA). Implant migration was evaluated using radiostereometric analysis (RSA). Five different Patient Reported Outcome Measures (PROMs) were reported at each follow-up appointment. Evaluations were performed with regular intervals from day 1 (baseline) until 120 months after surgery.

Result: Hip anatomy was restored to a favourable range.
BMD in the proximal femur decreased 7.8 % from baseline until 120 months postoperatively.
RSA showed no significant subsidence of the stem (P 0.001) from 5 to 10 years, but a slight varus rotation over 10 years.
Clinical result revealed promising results in all PROMS 120 months after surgery.

Conclusion: This femoral stem has shown good long term durability. The stem remains well fixated, induce minimal stress shielding and the clinical results are comparable to conventional uncemented stems~~.~~. Further studies comparing the ultra-short implant with a conventional implant in a randomized design is needed.

P46

ANTERIOR VERSUS POSTERIOR SPINAL ARTHRODESIS FOR SPINAL DEFORMITIES: COMPARISON OF CURRENT OUTCOMES

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Introduction: Spinal fusion surgery has become a widely adopted method for managing degenerative spine conditions, with a substantial rise in its utilization. This investigation delves into the clinical outcomes associated with both anterior and posterior approaches in spinal arthrodesis, a frequently performed and significant surgical intervention.

Methods: To thoroughly evaluate the postoperative outcomes linked to anterior and posterior spinal arthrodesis techniques in spinal deformities, a retrospective analysis was undertaken utilizing the NSQIP database spanning from 2016 to 2021. Chi-square and F-anova tests were employed for statistical analysis.

Results: Between 2016 and 2021, among the 2069 patients included in the database, 1836 underwent surgery via the posterior approach, while 233 underwent surgery via the anterior approach. All patients underwent procedures involving more than two vertebral segments. The re-surgery rates were 6.0% and 7.7% for posterior and anterior approaches, respectively ($p=0.318$). Rates of prolonged hospitalization and withdrawal of life were below 2%, with no statistical significance. Additionally, rates of surgical site infections (SSIs), stroke, myocardial infarction (MI), deep vein thrombosis (DVT), and pulmonary embolism (PE) were negligibly low (< 1.5%) and exhibited no significant differences between the two approaches ($p>0.05$).However, a notable discrepancy emerged between the groups: the need for transfusion was significantly higher in the posterior approach group (48.3% vs. 20.0%), while the incidence of acute kidney injury (AKI) was significantly higher in the anterior approach group (0.1% vs. 1.0%), contrary to expectations.

Conclusion: These findings underscore the importance of carefully considering patient-specific factors and surgical technique when planning spinal fusion procedures, with a keen awareness of potential complications associated with each approach. Further prospective studies are warranted to validate these observations and refine clinical practice guidelines for optimizing patient outcomes in spinal arthrodesis surgeries.

P47

ARE DISTAL FEMORAL VALGUS CUT ANGLES RELIABLE IN CLINICAL OUTCOMES OF TOTAL KNEE ARTHROPLASTY?

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Introduction: Total knee arthroplasty (TKA) is widely performed surgical procedure for advanced knee osteoarthritis.Alignment of femoral component is critical to success of TKA. However, optimal valgus cut angle for the femoral component(DFVC) remains debated. This study aims to evaluate impact of DFVC angles on TKA outcomes. It focuses on determining the most effective surgical approach by analyzing postoperative alignment, functional outcomes and complication rates associated with varying DFVC angles

Method: A retrospective analysis was conducted on patients who underwent primary TKA between June 2020 and December 2023. Patients were divided into three groups based on DFVC angle: Group A (<5°), Group B (5-7°) and Group C (>7°) (aged 48-76). Comorbidities were assessed. All surgeries were performed by the same surgeon using medial parapatellar incision technique and the same implant brand. Postoperatively all patients received the same physical therapy protocol and recommendations. Preoperative and postoperative radiographic measurements were compared to assess alignment. Functional outcomes were evaluated using Knee Society Score (KSS) and range of motion (ROM). Perioperative complications were recorded and analyzed.

Result: Total of 150 patients're included with 50 in each group.Postoperative radiographic analysis revealed that patients in Group B had the most optimal postoperative alignment ($p < 0.05$). There was no significant difference in functional outcomes, as assessed by ROM, among groups.No significant difference was observed in KSS scores among groups postoperatively. Group C had relatively higher average age. Group A had higher incidence of rheumatologic diseases. No patient exhibited postoperative instability. No significant complications that would impede the study's evaluation were detected.

Conclusion: Our findings suggest that DFVC angle between 5° and 7°may provide optimal alignment results in TKA. However, this angle doesn't significantly impact functional outcomes or complication rates. Further prospective studies with larger sample sizes're needed to validate these findings and establish definitive guidelines for femoral component alignment in TKA.

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BILATERAL SLIPPED CAPITAL FEMORAL EPIPHYSIS IN A CHILD WITH CEREBRAL PALSY: A RARE CASE REPORT AND LITERATURE REVIEW

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Introduction: This study aims to show that, although rare, the relationship between cerebral palsy (CP) and slipped capital femoral epiphysis (SCFE) is possible. To our knowledge, no other case of bilateral SCFE in a CP patient has been reported in the literature.

Method: An 8-year-old male with quadriplegic spastic CP and epilepsy presented to the emergency department (ED) with complaints of avoiding weight-bearing on the lower extremities, without a trauma history. The patient had no known endocrinological disease but was under pediatric nephrology follow-up for kidney stones.

Results: In the ED, hip flexion was painful bilaterally, extension was complete, and internal rotation was 30 degrees. Both thighs measured 30 cm in circumference with no discrepancy. There was no increase in temperature or redness in the lower extremities. Radiological examinations revealed bilateral SCFE. The patient underwent surgery within 12 hours, and both femoral heads were fixed with a single partially threaded cannulated screw without reduction. Postoperative rehabilitation started in the second week to prevent increased spasticity, with weight-bearing restricted for eight weeks. At the eight-week follow-up, the patient was mobilized with AFOs. The most recent follow-up showed painless hip movements, with 110 degrees of bilateral hip flexion, complete extension, no abduction or rotational limitations. The patient could sit unsupported and mobilize with AFOs.

Conclusion: Although the patient's presentation with quadriplegic spastic CP, absence of trauma history, no seizures for 1.5 years, and lack of endocrinopathy initially led us away from a diagnosis of bilateral SCFE, frog-leg and standard pelvis radiographs revealed SCFE. Early intervention and regular follow-ups facilitated the patient's ambulation. Although we found no similar cases in the literature, the possibility of encountering similar cases in the future should be considered, and SCFE should be included in the differential diagnosis for CP patients presenting with similar symptoms.

P49

COMPREHENSIVE ASSESSMENT OF 30-DAY CLINICAL OUTCOMES FOLLOWING MUSCLE TRANSFER OF UPPER EXTREMITY

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Introduction: Muscle transfer surgeries are complex procedures used in the management of musculoskeletal and neurologic conditions. Understanding the associated factors and outcomes is crucial for optimizing patient care and surgical planning.

Method: This retrospective database analysis utilized the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database from 2017 to 2021. Patient data from the ACS NSQIP database

Result: Preoperative factors indicated a male predominance (60.2%) among patients. The Hispanic background was noted in 4.6% of cases. Common preoperative comorbidities included hypertension (18.9%), diabetes (4.1%), and smoking (16.8%), while COPD, CHF, and malignancy were absent. Most patients had an ASA classification of III/IV (21.4%). Operative factors revealed an average operative time of 135 minutes and a short length of stay (1.1 days). The majority of surgeries were performed by the Orthopedics department (70.4%). Postoperative outcomes showed minimal complications: no 30-day mortality, unplanned intubation, deep vein thrombosis, stroke, MI, pulmonary embolism, or need for reoperation within 30 days. The incidence of urinary tract infection was low (0.5%). None of the patients required ventilator support, experienced sepsis, septic shock, unplanned readmission, or prolonged length of stay (>30 days). Reoperation rates beyond the initial procedure were also notably low.

Conclusion: Muscle transfer surgeries in this cohort demonstrated favorable outcomes with low complication rates. These findings provide valuable insights into patient characteristics and procedural outcomes, supporting further research to optimize patient selection and perioperative management strategies for muscle transfer procedures.

P50

CONSTRAINED ACETABULAR LINERS IN THE INSTABILITY OF HIP ARTHROPLASTY: WHAT IS ITS CURRENT ROLE IN REVISION SURGERY?

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Introduction: Dislocation of a total hip arthroplasty (THA) is a highly disabling complication following the implantation of primary and revision hip arthroplasties. This study is designed to evaluate the survival rate, functional outcomes, and the reasons for further revision due to implant failure of Constrained Acetabular Liners (CALs).

Method: 56 patients underwent hip revision surgery using CALs between June 2018 and December 2022 were retrospectively evaluated. Inclusion criteria consisted of age > 18 years, follow-up of at least 12 months, a history of recurrent implant dislocation, or the presence of a high risk of implant instability in hip revisions due to mechanical conditions.

Result: The average age at the time of surgery was 72.4±12.4 years. 55.6% of implants were performed for recurrent dislocation of THA, 8.9% for recurrent dislocation of bipolar hemiarthroplasty, 13.3% for aseptic loosening revisions, 4.4% for adverse reactions to metal debris revision procedures, and 17.8% for two-stage revision for periprosthetic joint infection. The average follow-up at the final evaluation was 32±12.3 months. The survivorship of the implant was 88.9% at final follow-up. At the final follow-up: average HHS 77.4±13.2; average WOMAC 31.4±13.4; average OHS 32.1±6.9; and average FJS-12 69.5±19.6., and 65% showed excellent or good outcomes (HHS>80).

Conclusion: The CALs assessed in this study have shown satisfactory functional outcomes, even when compared with other anti-dislocation systems available on the market. Both cemented and uncemented solutions have shown a good survival rate in the mid-term. However, their use should be reserved for selected cases.

P51

DOES MALNUTRITION AFFECT POSTOPERATIVE COMPLICATIONS IN EOS PATIENTS UNDERGOING GROWING ROD SURGERY? A RETROSPECTIVE COHORT STUDY

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Introduction: Early onset scoliosis (EOS) is a type of scoliosis that occurs before the age of 10. Treatment options include conservative measures and surgical interventions such as growing rod surgery. The growing rod technique involves the implantation of expandable rods to correct the spinal deformity while preserving growth potential. However, this technique carries risks and complications, including implant-related issues and spine morphology-related complications. Nutritional status is crucial for surgical outcomes, as EOS patients may experience malnutrition or overnutrition. This study aims to investigate the relationship between preoperative nutritional status and postoperative complications in EOS patients after growing rod surgery.

Method: A retrospective cohort study was conducted, including 53 patients with EOS who underwent growing rod surgery between January 2016 and January 2023. The patients' height and BMI were adjusted using the Ylikoski formula to obtain accurate nutritional status. This study compared perioperative complications between patients with normal nutritional status and those with malnutrition, and further explored the impact of nutritional status, type of scoliosis, and number of surgeries on complications.

Result: In this study, a total of 14 complications were observed out of 86 surgeries. Patients in the malnutrition group had a higher rate of complications compared to those normal nutrition patients, but statistical significance was only observed after nutritional adjustment (23.9% vs. 7.5%, $P < 0.05$). Furthermore, logistic regression analysis in this study revealed that the type of spinal curvature, having undergone surgery more than 3 times, and preoperative nutritional status (after adjustment) were all factors influencing complications following growing rod surgery.

Conclusion: EOS patients with preoperative malnutrition have a higher incidence of complications following growing rod surgery. Correcting height and BMI for EOS patients can provide a more genuine and accurate reflection of their nutritional status. Timely intervention should be implemented for patients with poorer nutritional status.

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DUAL MOBILITY TRAPEZIOMETACARPAL JOINT ARTHROPLASTY: INTERNATIONAL VARIATIONS IN SURGICAL TECHNIQUES AND PATIENT MANAGEMENT.

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Introduction: Base of thumb (trapeziometacarpal joint, TMCJ) arthritis is the second most common location of osteoarthritis in the hand. Although traditionally treated with a resection arthroplasty of the trapezium (trapeziectomy), base of thumb total joint replacement using dual-mobility implants is now rapidly gaining popularity. The indications, surgical technique and postoperative rehabilitation of dual mobility TMCJ arthroplasty is rapidly evolving. The aim of this study was to obtain detailed insight into the variations in indications, surgical technique, and rehabilitation for TMCJ arthroplasty with dual mobility implants, across a large international cohort of hand surgeons performing this procedure.

Method: An anonymised online survey was developed and distributed to the international hand surgery community of surgeons performing TMCJ arthroplasty. Responses were summarised, and a sub-analysis comparing highly experienced surgeons to less experienced surgeons was performed.

Results: Overall, 203 respondents were included, 59 of whom were considered highly experienced. Most respondents indicated that they perform TMCJ arthroplasty under regional anaesthesia (84%), via a dorsolateral approach (78%), with image-guidance for cup placement (84%). However, there is also considerable variation, mainly in post-operative immobilisation, 1st extensor compartment release, and handling of scaphotrapeziotrapezoidal (STT) joint arthritis and revision techniques.

Conclusion: Dual mobility TMCJ arthroplasty has evolved over the last decade. This survey shows that there is considerable variation among surgeons with indications, surgical technique, and rehabilitation. These findings have identified potential topics for future research to optimize the outcome of this increasingly popular procedure for a common problem.

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EFFECT OF BODY MASS ON REOPERATION RATE FOR DISTAL FEMUR FRACTURES

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Introduction: Obesity is a known risk factor for reoperation for nonunion in distal femur fractures. Increased load placed on the fixation constructs may contribute to nonunion. Our hypothesis is that increased patient body mass will correlate with increased rate of reoperation to promote union and an increased rate of usage of dual fixation constructs.

Method: A retrospective review was performed by screening 329 distal femur fracture patients treated by fellowship trained orthopaedic trauma surgeons. We found forty-seven patients with high body mass, 111.6kg to 189.1kg (mean 129.4kg) and selected an age matched standard body mass control group of forty-seven patients, 66.2kg to 76kg (mean 71.5kg). Reoperation to promote union and dual fixation were used as the primary and secondary outcome measures respectively. We defined single fixation as either a lateral or medial plate or an IM rod and dual fixation as the use of medial and lateral column fixation and hybrid nail and plate fixation.

Result: The overall number of patients with a high body mass (>110kg) was 47/329 (14%). The reoperation rate was 2.1% (1/47) in the standard body mass group, and 10.6% (5/47) in the high body mass group. The dual fixation rate was 8.5% (4/47) in the standard body mass group and 19.1% (9/47) in the high body mass group. Logistic regression showed a significant correlation between increased body mass and risk of reoperation ($p = 0.04$) and a nonsignificant ($p = 0.20$) correlation between increased body mass and use of dual fixation.

Conclusion: Increased body mass is associated with increased reoperation rate to promote union in distal femur fractures. A greater sample size may be required to show statistically significant association between increased use of additional fixation to treat distal femur fractures with increased body mass.

P54

EFFECTIVENESS OF INTRA-ARTICULAR ANALGESIC COCKTAIL IN REDUCING POSTOPERATIVE PAIN AND IMPROVING RANGE OF MOTION FOLLOWING TOTAL KNEE REPLACEMENT

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Introduction: Postoperative pain management is a critical component in the recovery of patients undergoing total knee replacement (TKR). This study investigates the effectiveness of an intra-articular analgesic cocktail in reducing postoperative pain and improving range of motion (ROM) following TKR.

Method: In this observational study, 103 patients with primary osteoarthritis undergoing primary TKR at three tertiary care centers were evaluated. Participants were divided into two groups: one receiving an intra-articular cocktail injection (intervention group) and the other receiving standard care (control group). Pain levels were assessed using the Visual Analog Scale (VAS) at 6 hours, 24 hours, 1 week, and 1 month post-surgery. ROM was measured at similar intervals. The Mann-Whitney U test was applied for pain score analysis, and the unpaired Student's t-test for ROM evaluation.

Result: The average age of participants was 63.0 ± 8.79 years, with a male-to-female ratio of 1:5. The intervention group showed a significant reduction in pain scores at 6 hours post-surgery ($p=0.003$) but not at 24 hours ($p=0.270$) and 1 week ($p=0.238$). Regarding ROM, no significant difference was observed at 24 hours and 1 week; however, there was a significant improvement in the intervention group at 1 month ($p=0.015$).

Conclusion: The use of an intra-articular analgesic cocktail in TKR significantly reduced immediate postoperative pain at 6 hours and improved ROM at 1 month post-surgery. These findings suggest that this approach may enhance early postoperative recovery in TKR patients.

P55

EXTENSIVE EVALUATION OF ENDOSCOPIC DISCECTOMY: A RETROSPECTIVE REPORT ACROSS MULTIPLE CENTERS

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Introduction: Endoscopic Discectomy-Minimally Invasive Spine Surgery (ED-MISS) is garnering attention for its potential to transform the surgical landscape of lumbar discectomy. In the realm of endoscopic and robotic surgery, Minimal Invasive Spine Surgery (MISS) is gaining popularity, with ED-MISS emerging as a frontrunner.

Methods: This retrospective database analysis utilized the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database from 2017 to 2021. Patient data from the ACS NSQIP database, particularly those who underwent CPT code 62380 procedures, were analyzed to discern preoperative, operative, and postoperative factors, meticulously noting any complications or reoperations.

Results: Analysis of the ACS NSQIP data revealed a significant increase in the Endoscopic/Open ratio over the years, indicating a growing preference for endoscopic approaches. Preoperative factors, including gender, race, and comorbidities, were distributed across the patient cohort. Operative factors, such as surgical characteristics, department, and anesthesia type, were also noted. Postoperative complications were relatively low, with bleeding transfusions, prolonged length of stay, and organ surgical site infections each occurring in only 0.4% of patients. The reoperation rate was also low, with only 1.6% of patients necessitating reoperation.

Conclusion: This study underscores the growing trend of ED-MISS and its potential to redefine lumbar discectomy. Future research is warranted to comprehensively compare the effectiveness and safety of ED-MISS versus traditional open techniques, guiding the optimization of patient care and surgical strategies.

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INTRAOPERATIVE GROSS APPEARANCE OF THE PCL CAN'T BE AN INDICATOR FOR PCL PRESERVATION OR RESECTION IN TKA.

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Background: No study has evaluated whether the intraoperative gross appearance of the posterior cruciate ligament (PCL) affect the *in vivo* PCL function in preoperative Osteoarthritis (OA) knee and postoperative cruciate-retaining (CR) total knee arthroplasty (TKA). The purpose of this study was to compare whether differences in intraoperative gross appearances of the PCL affect preoperative OA knee and postoperative in vivo function in CR-TKA.

Methods: The intraoperative gross appearances of the PCLs were evaluated and examined their correlations with clinical parameters, corresponding histological features, and the *in vivo* function of the PCL before and after CR-TKA. A scoring for intraoperative gross appearance of the PCL was used for group classification; normal to subtle degenerative change (Group N), moderate degenerative change (Group M), and severe degenerative change (Group S).

Results: A total of 71 knees in 45 patients were enrolled. Preoperative maximum knee flexion knee angle under anesthesia in group N, M, and S were 129.8°, 125.0°, and 127.8°, respectively (significance between group N and M). There was no significance among each group in intraoperative joint laxity, pre- and post-operative PCL tension, pre- and post-operative amount of rollback, pre- and post-operative maximum knee flexion angle under anesthesia, component alignment angle, and the histological scoring of the residual PCL. There was also no significance among each group in postoperative maximum knee flexion angle at final follow up.

Conclusions: The intraoperative gross appearances of the PCL were associated with preoperative clinical features, but its gross appearance did not affect pre-, intra-, and post-operative in vivo function of residual PCL in CR-TKA.

P57

LONG-TERM OUTCOMES FOLLOWING TUMOR RESECTION AND VASCULARIZED FIBULAR GRAFTING IN DENMARK

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Introduction: Vascularized fibular grafting following tumor resection is an essential treatment option in limb salvage surgery. This study aimed to assess the surgical and oncological outcomes of patients treated in Denmark between 2010 and 2022.

Method: We present a retrospective review of a national cohort comprising 27 patients. The indications were 13 cases of Ewing sarcoma, 12 cases of osteosarcoma, and 2 cases of giant cell tumor. The median age at surgery was 16 years (range: 2-39), and the median follow-up was 82 months (range: 12-138). Patients were analyzed overall and stratified into upper and lower extremity groups based on tumor location.

Result: The primary rate of graft union was 63%, and after secondary procedures, the overall rate of graft union was 67%, with a median time to union of 13 months (range: 7-29). The reoperation rate was 74%, while the rate of limb salvage was 93%, with two patients undergoing amputation during follow-up. The 5-year overall survival rate was 81% (95% CI: 61-92). Patients with upper extremity tumors were more likely to attain graft union (92% vs. 47%, p=0.02) and less likely to undergo multiple reoperations (17% vs 60%, p=0.047) compared to patients with lower extremity tumors.

Conclusion: Vascularized fibula grafting remains a valuable option in limb salvage surgery with acceptable long-term outcomes. However, especially in lower extremity cases, a low rate of graft union and multiple reoperations are to be expected.

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MANIPULATION UNDER ANESTHESIA: DOES IT EFFECT PROMS IN ELECTIVE PRIMARY TKA PATIENTS?

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Introduction: Total knee arthroplasty (TKA) is an effective and reliable treatment for patients with osteoarthritis. A common complication is stiffness due to arthrofibrosis, which can be treated with manipulation under anesthesia (MUA). Patient-reported outcome measures (PROMs) can be used to determine the success of the surgery.
This study aims to compare PROMs between MUA patients and no-MUA patients at baseline before elective primary TKA and at follow-up 1 and 2-years postoperative.

Method: This retrospective cohort study is based on elective TKA patients operated at our local hospital between 2015 and 2021. Patients prospectively completed questionnaires containing Oxford Knee Score (OKS), EQ-5D-3L, and Copenhagen Knee ROM scale (CKRS) preoperatively, 1 and 2-years postoperative. Patients were divided into two groups, depending on whether they received a MUA or not.
Data was compared using T-test and linear regression to adjust for gender, age, BMI, and ASA-score.

Result: For the MUA group the OKS at baseline, 1-year and 2-year follow-up were 20.8, 35.9 and 36.3 compared to 21.1, 38.3 and 39.3 for the no-MUA group, showing significant results a follow-up. EQ-5D-3L were 0.536, 0.846 and 0.850 for the MUA group as opposed to the no-MUA group's 0.601, 0.836 and 0.841. EQ-5D-3L-VAS were respectively 62.7, 79.1 and 70.3, and 61.5, 78.2 and 77.2. EQ-5D-3L at baseline and EQ-5D-3L-VAS at 2-year follow-up were significant. CKRS showed no significant results between the MUA and no-MUA group with extension scores of 3.35, 3.86 and 4.02 compared to 3.26, 4.00 and 4.04. Flexion scores were at 4.98, 4.44 and 5.00 in the MUA group, while the no-MUA group scored 4.63, 5.01 and 5.14.

Conclusion: OKS were similar at baseline, but no-MUA patients scored 2.4 and 3 points higher than MUA patients at 1 and 2-year follow-up, though not clinically relevant. Further prospective studies are needed in order to investigate long-term effects of MUA.

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META ANALYSIS OF CURRENT UPPER EXTREMITY REPLANTATION OUTCOMES

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Introduction: Upper extremity replantation surgery has become a crucial intervention for individuals experiencing traumatic limb loss, offering the promise of restored function and improved quality of life. Functional outcomes, encompassing sensory and motor function restoration, alongside patient satisfaction, are pivotal to the success of these procedures. This review aims to examine current upper extremity replantation outcomes, highlighting achievements, and pinpointing areas for improvement in optimizing functional recovery. Through a thorough analysis of existing literature, we aim to offer insights into the functional outcomes following replantation procedures.

Method: A comprehensive literature search spanning from the 1980s to February 2024 was conducted to identify studies on upper extremity replantation with functional outcomes categorized using the Chen classification. Out of 362 papers initially identified, 12 were included in the final analysis. Data from these studies were analyzed using the JAMOVI software program.

Result: Our analysis of replantation surgeries from various studies reveals encouraging outcomes in sensory and motor function restoration. Among the 303 patients and 357 replantations included in the studies, the combined success rate for Chen 1&2 outcomes was 63.70%, with Chen 3 outcomes standing at 28.05%. These results underscore the effectiveness of replantation procedures in achieving favorable neurological outcomes. However, Chen 4 was observed at a rate of 8.25%. Notably, individual studies demonstrated varying success rates, with some achieving exceptional outcomes, such as a 100% success rate in Chen 1&2 cases. There was reported only two mortality, and these were not related to the procedure.

Conclusion: Our meta-analysis underscores positive outcomes in sensory and motor function restoration following upper extremity replantation surgeries. Further research is imperative to refine techniques and minimize complications, ultimately enhancing outcomes in upper extremity replantation.

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MUSCLE STRENGTH AND POWER IN PATIENTS WITH CHRONIC PAIN AFTER TOTAL KNEE ARTHROPLASTY: SECONDARY ANALYSIS FROM A RANDOMIZED CONTROLLED TRIAL

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Introduction: There is a lack of evidence-based treatments for patients with chronic pain after total knee arthroplasty (TKA). It is well-established that knee extensor and flexor muscle strength are markedly impaired following TKA, but no studies have examined muscle strength and power in patients with chronic pain after TKA. Therefore, the aim was to investigate if neuromuscular exercises and pain neuroscience education (PNE) were superior to PNE alone for improvement of muscle strength and power in patients with chronic pain after TKA.

Method: This report presents the exploratory analysis of a randomized controlled trial (NCT03886259). Participants with chronic moderate-to-severe average daily pain intensity and no signs of prosthesis failure at least one year after primary TKA were included. Participants were randomized to receive either supervised neuromuscular exercise and PNE or the same PNE sessions alone. The outcomes were changes from baseline to 12-months for peak leg extension power and maximum muscle strength, measured during maximal voluntary isometric contractions, for the knee extensors and flexors.

Result: Sixty-nine participants (age 62.2±7.2, 40 females) were included. No between-group differences were observed for peak leg extension power (difference 13.6 Watts, 95% CI -22.2 to 49.3), maximum knee extensor muscle strength (difference -20.9 Newtons, 95% CI -65.8 to 24.0) or maximum knee flexor muscle strength (difference 8.6 Newtons, 95% CI -11.9 to 29.1). Peak leg extension power (26.3 Watts, 95% CI 4.3 to 48.3) and maximum knee flexor muscle strength (19.7 Newtons, 95% CI 7.6 to 31.9) improved significantly in the neuromuscular exercise and PNE group with no significant improvements observed in the PNE alone group.

Conclusion: Neuromuscular exercise and PNE did not improve muscle strength and power compared to PNE alone in patients with chronic pain after TKA.

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PATIENTS WITH CHRONIC LIMB-THREATENING ISCHEMIA, EXPERIENCES OF THEIR DISEASE, TREATMENT, AND CARE IN A CROSS-SECTORIAL SETTING. A SCOPING REVIEW

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Introduction: Chronic limb-threatening ischemia (CLTI) is accompanied by high utilization of healthcare services, with multidisciplinary professionals providing care in primary and secondary settings. CLTI is a progressive disease that induces physical, emotional, and social burden on the patients, but also requires high patient adherence to avoid severe complications. To our knowledge, no previous studies has focused on the patient perspectives related to this topic. The objective of this review was to systematically identify, examine, and conceptually map the existing literature on patients who have CLTI in the context of living with the condition, and explore their experiences of living with CLTI and their treatment and care within a cross-sectoral setting.

Method: A systematic search was conducted and completed on September 18th, 2023, without methodological or format restrictions. We identified Population, Concept, and Context to pinpoint the focus of this review process. The JBI methodology for scoping reviews and the PRISMA-ScR checklist were followed.

Results: Based on our search, we found ten relevant scientific qualitative and/or quantitative and one non-scientific sources. We identified four main maps: 1) Dependency on others is my new life condition; 2) I'm more than the sum of my conditions, 3) I'm lost in chaos, be alert to all of me, and 4) Give me more time, my body and mind are under attack.

Conclusion: This scoping review describes how patients' life is affected by the CLTI and their perception of both shared decision-making alongside treatment and care, emphasizing the need for more person-centered care. To nuance person-centred care further, it is necessary to consider the impact of patients' cultural values and preferences, about which there is a notable gap in research.

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PERIOPERATIVE CLINICAL OUTCOMES OF TOTAL HIP REPLACEMENT IN GERIATRIC PATIENTS WITH DEMENTIA: HOW MUCH FEASIBLE IS IT?

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Introduction: Scientific evidence in orthopedic surgery strongly links dementia to higher mortality rates following hip fracture surgeries. In this study, we comprehensively report and evaluate total hip replacement outcomes in geriatric patients with dementia.

Methods: In this study, utilizing data from the National Surgical Quality Improvement Program (NSQIP) participant usage file (PUF) database spanning the years 2016 to 2021.

Result: Hip replacement surgery in geriatric patients with dementia presents various postoperative outcomes, as depicted in the accompanying table. Among the 412 patients included in the study, the most notable outcomes within 30 days post-surgery include a 3.4% (n=14) incidence of 30-day mortality. Other complications such as deep vein thrombosis (1.2%, n=5), urinary tract infection (3.2%, n=13), stroke (1.2%, n=5), and myocardial infarction (1.2%, n=5) were also observed. However, acute renal failure and progressive renal insufficiency were notably absent in this cohort. Need for transfusion was prevalent, with 12.1% (n=50) of patients requiring it. Additionally, a small proportion of patients necessitated ventilator support (0.2%, n=1) and experienced sepsis or septic shock (0.2%, n=1 each). Unplanned readmission within 30 days occurred in 1.7% (n=1) of cases, while 3.2% (n=13) underwent unplanned reoperation during the same period. Notably, there were no instances of patients requiring more than two reoperations. Prolonged length of stay exceeding 30 days was observed in 1.0% (n=4) of the patients undergoing hip replacement surgery.

Conclusion: In summary, our study on total hip replacement outcomes in geriatric patients with dementia reveals a complex risk profile. Notable findings include the absence of acute renal failure and major complications like unplanned readmissions and reoperations within 30 days, which stood at around 3%. These findings emphasize the importance of tailored perioperative management strategies for this vulnerable population.

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PROGNOSTIC VALUE OF BLOOD PARAMETERS IN NON-TRAUMATIC AMPUTATION PATIENTS: A RETROSPECTIVE COHORT STUDY

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Introduction: This study aims to identify the blood parameters influencing prognosis and morbidity in patients undergoing non-traumatic amputations.It seeks to determine the association between these parameters and post-operative outcomes, including infection rates, wound healing time, revision surgery, overall morbidity, mobility status, and quality of life.By identifying significant predictors among hemoglobin (Hb), white blood cell (WBC), platelet count (PLT), C-reactive protein (CRP), erythrocyte sedimentation rate (ESR) and albumin levels, we aim to enhance clinical management and post-operative care of this patient population.

Method: A retrospective cohort study of 120 patients (80M, 40F) who underwent non-traumatic amputations between January 2018 and December 2022 was conducted. Data included demographics, underlying conditions, amputation type, and blood parameters such as Hb, WBC, PLT, CRP, ESR, and albumin levels.Patients were followed for minimum of 12 months post-amputation. Prognosis was assessed based on wound healing time, infection rates, and need for revision surgery. Morbidity was evaluated through mobility status and quality of life using the Short Form Health Survey (SF-36).

Result: The study found that elevated WBC, CRP,ESR levels were significantly associated with increased infection rates and longer wound healing ($p < 0.05$). Low albumin levels were linked to poorer prognosis, higher revision surgery rates and decreased mobility ($p < 0.01$). Hb below normal range correlated with increased morbidity, manifesting as lower quality of life scores on SF-36. Multivariate analysis revealed that CRP and albumin levels were the most significant independent predictors of both prognosis and morbidity.

Conclusion: Blood parameters such as WBC, CRP, ESR, and albumin are key indicators of prognosis and morbidity in non-traumatic amputation patients. Elevated inflammatory markers and low albumin levels correlate with worse outcomes, including higher infection rates, prolonged wound healing, and reduced post-operative mobility. Monitoring these parameters can identify at-risk patients early, guiding targeted interventions to improve prognosis and quality of life.

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PROXIMAL FEMUR NAILING FOR FRACTURES: 30-DAY MORTALITY RATES ACROSS AGE/TRANSFUSION/LENGTH OF STAY

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Introduction: Proximal Femoral Nailing (PFN) is a widely utilized technique for stabilizing fractures of the proximal femur, particularly in elderly patients who are prone to such injuries. Despite advancements in surgical techniques and postoperative care, mortality within the first month following PFN remains a significant concern. Identifying the determinants of this early mortality is essential for optimizing patient outcomes and guiding clinical decision-making.

Methods: This retrospective database analysis utilized the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database spanning from 2017 to 2021. Patient data from the ACS NSQIP database were extracted using CPT code 27245, pertaining to the treatment of intertrochanteric, peritrochanteric, or subtrochanteric femoral fracture with intramedullary implant, with or without interlocking screws and/or cerclage. Our investigation focused on 30-day mortality outcomes. The final analysis comprised 26,454 cases of PFN.

Result: The study cohort consisted of 26,454 cases and 30-day mortality rate was stood at 5.8%. All increasing age, increasing number of transfusion products and prolonging length of stay associated with increased risk of 30-day mortality in curve fit regression test ($P<0.001$). The ROC analysis revealed that more than 1 unit of transfusion, age 80 and after 6th day of LOS were cut off for risk of 30-day mortality($P<0.001$),

Conclusion: Our findings highlight the importance of considering patient age, transfusion requirements, and length of hospital stay in predicting postoperative 30-day mortality. Identifying these determinants allows for risk stratification and may guide clinicians in optimizing patient care strategies. Further research and interventions aimed at addressing these factors are warranted to improve outcomes and enhance patient safety in PFN procedures.

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PULLOUT REPAIR IS BENEFICIAL FOR PATIENTS WHO HAVE LOW-GRADE SUBCHONDRAL INSUFFICIENCY FRACTURE OF THE KNEE ASSOCIATED WITH MEDIAL MENISCUS POSTERIOR ROOT TEAR

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Introduction: Medial meniscus (MM) posterior root tear (PRT) causes MM extrusion and can lead to subchondral insufficiency fracture of the knee (SIFK). However, the progression of SIFK after MMPRT pullout repair remains unknown. The aim of this study was to investigate the progression of SIFK and compare clinical outcomes in patients with SIFK to those without SIFK after MMPRT pullout repair. We hypothesized that the progression of SIFK would be prevented by pullout repair, and clinical outcomes would improve in all patients.

Method: The SIFK grade (1-4) was evaluated using T2-fat suppression magnetic resonance imaging. Thirty-eight patients without SIFK (n = 22) and with low-grade SIFK (1 and 2; n=16) who underwent MMPRT pullout repair were included. Preoperative factors, such as the duration from injury to the time of magnetic resonance imaging/surgery (weeks), femorotibial angle (degree), MM extrusion (mm), and clinical outcomes were evaluated, as well as the progression of SIFK.

Result: SIFK was identified in 9 patients (grade 1) postoperatively. Significantly improved clinical outcomes were observed in all patients. Preoperative femorotibial angle, MM extrusion, and duration from injury to the time of magnetic resonance imaging/surgery were 177.1±1.5º, 3.2±1.6 mm, and 6.4±7.0/10.1±7.5 weeks, respectively. No significant difference in preoperative factors and clinical outcomes was observed between patients with low-grade SIFK and those without SIFK.

Conclusion: MMPRT pullout repair prevented the progression of low-grade SIFK and improved clinical outcomes in all patients. MMPRT pullout repair could be a good treatment option for optimizing clinical outcomes in patients with low-grade SIFK.

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PREDICTING FRACTURES IN ADJACENT VERTEBRAE POST-VERTEBROPLASTY USING A MACHINE LEARNING APPROACH

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Background: Vertebroplasty demonstrates promising clinical outcomes owing to its straightforward surgical procedure, minimal complications, and rapid pain alleviation (1). Nevertheless, post-treatment, 25% of patients encounter vertebral fractures, with 50-67% of such instances observed in neighboring augmented vertebrae (2).

Purpose: This study aims to employ machine learning methodologies and classification techniques to construct predictive models based on identified variables, with the goal of forecasting fractures in adjacent vertebrae subsequent to vertebroplasty.

Methods: This retrospective investigation aimed to identify potential determinants impacting the efficacy of vertebroplasty. Utilizing data from 84 patients diagnosed with osteoporotic vertebral compression fractures who underwent vertebroplasty, predictive models were constructed. K-nearest neighbors (KNN) and logistic regression (LR) algorithms were employed for the prediction of fractures occurring at the adjacent level of the augmented vertebra post-vertebroplasty. The accuracies of these models were documented.

Results: The developed models demonstrated high accuracies, with LR achieving 0.94, and KNN achieving 0.88. Bone mineral density (BMD), cement volume, and cement location emerged as the most significant features in LR. Furthermore, LR exhibited superior performance in terms of macro average (0.92) and weighted average (0.95) accuracy metrics.

Conclusion: The attained high accuracies underscore the efficacy of the developed models in forecasting subsequent adjacent vertebral fractures subsequent to vertebroplasty. Employing these models facilitates accurate fracture prediction, thereby aiding in the prevention of ensuing complications.

Declaration of interests
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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UNDERSTANDING WHAT MATTERS TO PATIENTS UNDERGOING COSMETIC STATURE LENGTHENING: A SYSTEMATIC SCOPING REVIEW TO EXAMINE OUTCOME MEASURES REPORTED IN THE LITERATURE TO ASSESS HOW WELL THEY REFLECT REAL PATIENT EXPERIENCES

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Introduction: The literature on cosmetic limb lengthening has many limitations. Studies often provide a low level of evidence, with varying techniques and outcome reporting, with some studies missing important outcomes and others using unvalidated outcome scores. This makes it difficult to compare functional outcomes between the lengthening techniques used. This systematic scoping review aimed to identify areas that may play an important role in the treatment process of patients undergoing cosmetic lengthening, but may have been neglected in the current literature.

Method: A systematic literature search was performed. All outcome measures reported in the included studies of cosmetic lengthening were extracted and simultaneously mapped to the overarching domains that bundled similar outcome measures. These domains were then further categorized according to the taxonomy developed by Dodd et al.

Result: 24 studies were included in the review. All reported outcome measures were extracted and then grouped into a total of 62 overarching domains. The average number of domains reported in each article was 17. The most common domain reported in the articles was lengthening (82%), followed by deformity correction and complications. Only 21% of all domains covered the impact of treatment on patients' lives, such as physical, social, role, and emotional functioning, quality of life, and patient satisfaction.

Conclusion: The current literature demonstrates the dominance of clinical outcome measures. These outcome measures are mostly limited to the broad domain of "musculoskeletal outcomes", which suggests that the domains of social, physical, and emotional health, which may be more important to patients than to clinicians, are neglected. These limitations in the domains covered by the current literature run the risk of not being relevant to patients. In addition, heterogeneity in the reporting of outcomes may lead to the use of ineffective or even harmful interventions and waste of already limited health care and research resources.

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THE PREVALENCE OF VARICOSE VEINS AND THE EFFECT OF VARICOSE VEIN TREATMENT WITH COMPRESSION STOCKINGS ON KNEE PAIN IN PATIENTS WITH KNEE OSTEOARTHRITIS

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Introduction: Varicose veins (VV) of the lower extremities are associated with knee pain or knee osteoarthritis (KOA). This study aimed to verify that the prevalence of VV of the lower extremities among patients with KOA is high and that knee pain can be improved by VV treatment.

Method: This was a prospective case series study. Female patients aged over 50 years with long-term knee pain and KOA were included in this study. This study was approved by our institutional review board. VV was diagnosed by detecting the reverse flow of venous blood over 0.5 second using duplex scanning by ultrasonography of the lower extremities. Patients were treated with compression stockings for VV treatments. Visual analogue scales (VAS) was administered at baseline and 4-12 months after treatment. Treatment outcomes were divided into five groups based on patients' outcome interview: group 1 (G1) "excellent improvement," showing improved knee pain with objective changes, including decreased pain medication usage or improved activities of daily living, (G2) "improvement," showing improved subjective knee pain, (G3) "slight improvement," showing improvement in some symptoms, but not knee pain (G4) "unchanged," (G5) "refused,".

Result: 72 women was included in this study (mean age 74 years). Of the 72 patients, 50 (69%) were diagnosed with VV, 48 patients with VV and 18 patients without VV started the treatment. 28 (58%)patients with VV and 2(11%) patients without VV were improved in knee pain as G1 or G2 ($p < 0.03$, Fisher's exact test). The mean score of the VAS in G1 or G2 significantly decreased from 5.8 to 2.4 ($p < 0.01$, the Wilcoxon signed-rank sum test).

Conclusion: The prevalence of VV of the lower extremities among patients with KOA is high as 69%. VV treatment with compression stockings has the potential to improve knee pain in patients with VV and KOA.

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REGIONAL DISPARITIES IN OSTEOARTHRITIS PREVALENCE: THE IMPACT OF AGING AND OBESITY ACROSS WHO REGIONS

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Introduction: This study aims to examine the relationship between factors such as aging and obesity and the prevalence of osteoarthritis (OA) from 2000 to 2016, and how these relationships vary across the six WHO (World Health Organization) regions (Africa, Americas, South-East Asia, Europe, Eastern Mediterranean, and Western Pacific).

Method: Data on OA prevalence, the percentage of the elderly population, and obesity rates were used to evaluate these relationships across the six WHO regions using static panel data regression analysis. The data were sourced from the Global Health Data Exchange, World Bank Database, and Our World in Data.

Result: Our findings reveal a wide distribution in OA prevalence, with an average of 794.47±183.5, showing significant regional and temporal differences. The prevalence of aging showed substantial variability among regions, averaging 6.72±3.01%, while obesity prevalence demonstrated notable regional differences with an average of 12.58±8.6%. Our panel data analysis indicates a significant positive effect of aging on OA prevalence($\beta = 26.65$, $p<0.001$), suggesting that an aging population contributes to the increase in OA cases. Conversely, obesity was found to have a significant negative effect on OA prevalence($\beta = -5.38$, $p<0.002$). Regionally, OA prevalence generally decreases over time, particularly in Africa, Eastern Mediterranean, and South-East Asia. Aging prevalence increases over time in all regions, especially in Europe and the Americas. Obesity prevalence also rises over time in all regions, with more pronounced increases in the Americas and Europe.

Conclusion: This study reveals significant regional differences in the relationship between OA prevalence, aging, and obesity across WHO regions. Aging populations contribute to rising OA cases, especially in regions with high aging prevalence. However, decreasing OA trends in Africa, Eastern Mediterranean, and South-East Asia suggest healthcare improvements. The inverse relationship between obesity and OA prevalence requires further research. Region-specific strategies are needed to manage OA and its economic burden effectively.

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REOPERATIONS AFTER PERCUTANEOUS NEEDLE FASCIOTOMY FOR DUPUYTREN'S CONTRACTURE

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Introduction: The risk of recurrence after Percutaneous Needle Fasciotomy (PNF) for Dupuytren's Contracture is a main point of criticism and has been reported up to 85% after just five years. A recent British study estimated the reoperation rate due to recurrence to be 34% within 10 years post PNF. The reoperation rate following PNF has not yet been assessed in a Scandinavian context.
The aim of this study was to estimate the reoperation rate due to recurrence in a large Danish cohort of PNF-treated patients.

Method: This is a register-based, follow-up study on PNF-treated patients at Silkeborg Regional Hospital, Denmark, between 2007 and 2015. The first PNF procedure during the study period was defined as index procedure. Succeeding data were extracted from the Danish National Patient Registry and the Danish Civil Registration System in 2018 to identify possible reoperation procedures. Medical records were reviewed to validate reoperations performed at Silkeborg Regional Hospital (Silkeborg cohort). We evaluated the "true" reoperation rate based on the Silkeborg cohort with further best/worst case scenario on the total cohort.

Result: A total of 2,257 unique patients (3,331 PNF-treated fingers) were identified. Of those, 1,724 (76%) patients (2,511 (75%) fingers) were included in the Silkeborg cohort. The reoperation rate in the Silkeborg cohort was 28% at a median follow-up time of 6.8 (IQR: 4.6-9.3, min-max: 1.0-11.7) years. The reoperation rate in the total cohort was estimated to be between 21% and 46% at median follow-up time of 7.2 (IQR: 4.9-9.5, min-max: 1.0-11.7) years.

Conclusion: This study provides valuable information on reoperations after PNF in a large Scandinavian cohort. This yields important new information for patients and doctors about treatment options and risks.

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SAME-DAY DISCHARGE TRENDS IN TOTAL KNEE ARTHROPLASTY: A NATIONWIDE ANALYSIS OF 367,365 PATIENTS AND 30,989 SAME-DAY DISCHARGES

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Introduction: The trend of same-day discharge in total knee arthroplasty is gaining traction in orthopedic surgery. Despite concerns about the absence of extended hospital care, evidence suggests various benefits, including reduced infection risk, financial savings, and improved psychosocial outcomes for both patients and physicians. This study evaluates the evolving patterns of same-day discharge in total knee arthroplasty procedures.

Method: This retrospective database analysis utilized the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database from 2017 to 2021. In our final analysis, we have assessed 367,365 TKA patients, and 30,989 of them were same-day dischargers.

Result: The preoperative status of patients undergoing knee procedures, whether same-day or hospitalized, exhibited significant variability. Demographically, the hospitalized knee group skewed towards a higher proportion of females (61.5%vs.54.2%, p=0.001) and older individuals (62.4%vs.56.9%, p=0.001) compared to the same-day knee group. Concerning medical comorbidities($p<0.001$). operative time was significantly different between same-day and hospitalized knee procedures, with the hospitalized knee group enduring a longer operative time on average (91.1±35.8 minutes) compared to the same-day knee group (84.2±28.2 minutes, p=0.001). Additionally, rates of 30-day readmission, encompassing both any readmission and procedure-specific readmission, along with reoperation within 30 days, were markedly elevated in the hospitalized knee group relative to the same-day knee group (all $p<0.001$). Notably, the 30-day mortality rate proved significantly higher in the hospitalized knee group compared to the same-day knee group (0.01% vs. 0.03%,p=0.001). Moreover, the prevalence of the same-day discharge concept experienced a remarkable ascent from 2016 to 2021, with rates escalating from 1.2% to22.9% of all total knee arthroplasties over a span of just six years.

Conclusion: In conclusion, same-day discharge is a feasible and safe option for selected TKA patients.

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SPINAL CARE IN A NATIONAL 22Q11.2 DELETION SYNDROME POPULATION ATTENDING A SPECIALISED SERVICE: A RETROSPECTIVE COHORT STUDY

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Introduction: Scoliosis affects half of children with 22q11.2 Deletion Syndrome (22Q11.2DS), a rare microdeletion syndrome. It can impact quality of life and necessitates ongoing medical surveillance due to its varying severity. This study aims to assess spinal care in the 22q11.2DS national paediatric cohort attending a specialised service established at CHI, Crumlin in 2017.

Method: A retrospective review of patients up to age 18 was conducted from October 2017 to June 2024. Data were extracted from paper charts and electronic medical records, including the Integrated Patient Management System and NIMIS RIS, and analysed using Microsoft Excel.

Result: Among 193 patients, 50.8% (n=98) were male. Following examination at the 22q clinic, 51.3% (n=99) had spinal X-rays at a mean age of 10 ± 4.5 years, either at diagnosis or prepubertally. Cobb angles were used to measure the severity of scoliosis. Of those X-rayed, 49.5% (n=49) had scoliosis (Cobb angle ≥ 10º), while 26.3% (n=26) had mild curvatures (<10º). A total of 53.5% (n=53) were referred to orthopaedics: 21.2% (n=21) by the 22Q clinic, and the remaining by other paediatric departments. Patients not referred were managed with an established care plan. The median wait time for an orthopaedic consultation was 9 months following referral (IQR 2), with a mean of 10.9 months. There was significant variability in patient wait times, ranging from 0 to 34 months. 30.6% (n=15) of patients referred required intervention with 10.2% (n=5) requiring each of bracing, surgery only, or both. The average age of surgical patients was 10 ± 3.3 years with 30% (n=3) experiencing post-operative complications.

Conclusion: This study shows a 49.5% prevalence of scoliosis in 22q11.2DS patients, underscoring the need for routine screening at diagnosis, prepubertally (10-12 years) and biennially at clinics. Prolonged wait times for orthopaedic care must be addressed to improve patient outcomes.

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THE EFFECTIVENESS OF SURGICAL INTERVENTION IN PROGRESSIVE PSEUDORHEUMATOID DYSPLASIA: A CASE REPORT OF A RARE CONDITION MIMICKING RHEUMATIC DISEASES

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Introduction: This case report aims to demonstrate the successful treatment of a patient with severe bilateral hip movement restriction and significant knee extension limitation through bilateral total hip arthroplasty and bilateral distal femoral extension osteotomy, resulting in pain-free and functional joint mobility. Additionally, we aim to emphasize that progressive pseudorheumatoid dysplasia (PPRD) should be considered in differential diagnoses, especially when rheumatic diseases are initially suspected.

Method: A four-year-old girl was evaluated at an external center for bilateral lower extremity weakness, initially suspected to have muscular dystrophy. At age eleven, she developed swelling in bilateral finger joints and occasional abdominal pain, leading to a suspicion of Familial Mediterranean Fever (FMF). Genetic testing revealed a positive MEFV gene, and she was started on 0.5 mg colchicine twice daily. While abdominal pain subsided, joint pain progressed. Despite negative acute phase reactants, arthritis attacks persisted, raising suspicion of PPRD. Genetic testing confirmed a homozygous mutation in the CCN6 gene, establishing the PPRD diagnosis.

Results: The patient presented to our clinic with bilateral hip and knee pain and movement restriction. Physical examination revealed a 60-degree flexion contracture in bilateral hip joints and a 30-degree extension limitation in bilateral knees. Bilateral total hip arthroplasty was performed two months apart, followed by bilateral distal femoral extension osteotomy eight months later. Three months postoperatively, the patient achieved full bilateral knee extension, could mobilize with support, and navigate stairs.

Conclusion: In this case, the presence of widespread joint pain, swelling, and accompanying abdominal pain initially suggested FMF. However, the persistence of joint symptoms and negative acute phase reactants indicated the need to consider genetic-based, non-rheumatologic disorders such as PPRD. This case highlights that PPRD can mimic rheumatologic diseases but is characterized by negative acute phase reactants and progressive joint degeneration, which can be effectively managed with orthopedic surgery, restoring patient mobility.

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THE IMPACT OF POSTOPERATIVE HEMOGRAM AND CRP BLOOD VALUES ON DAILY FUNCTIONAL RECOVERY FOLLOWING TOTAL KNEE ARTHROPLASTY

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Introduction: The study aimed to investigate the impact of postoperative blood values on the daily functional recovery of patients following Total Knee Arthroplasty (TKA). Understanding these relationships can aid in improving postoperative care and optimizing recovery protocols.

Method: A retrospective cohort study was conducted on 130 patients who underwent TKA between January 2020 and December 2022. Postoperative blood values, including hemoglobin, hematocrit, C-reactive protein (CRP), and white blood cell (WBC) counts, were collected at 24 hours and 72 hours post-surgery. Daily functional recovery was assessed using the Knee Society Score (KSS) and the Timed Up and Go (TUG) test at postoperative days 1, 3, 5, and 7. Statistical analysis was performed to evaluate correlations between blood values and functional recovery metrics.

Result: The study found significant correlations between certain postoperative blood values and daily functional recovery scores. Lower hemoglobin and hematocrit levels at 24 hours post-surgery were associated with delayed recovery times as measured by the TUG test ($p < 0.05$). Elevated CRP levels were linked to lower KSS scores, indicating decreased knee functionality and increased pain ($p < 0.01$). Higher WBC counts were also significantly associated with poorer functional outcomes, suggesting a potential inflammatory or infection response that hinders recovery ($p < 0.05$).

Conclusion: Postoperative blood values, particularly hemoglobin, hematocrit, CRP, and WBC counts, have a significant effect on the daily functional recovery of patients following TKA. Monitoring these parameters can provide valuable insights into the recovery process, potentially guiding personalized postoperative care strategies to enhance patient outcomes. Further research is warranted to develop targeted interventions based on these findings. Based on these findings, further research with more parameters is needed to develop targeted interventions.