

Abstract of the Scientific Works of Stoyan Ivanov, MD, PhD

1. Ivanov, S. Percutaneous fixation of intraarticular joint-depression calcaneal fractures with different screw configurations – a biomechanical human cadaveric analysis

- Focus: Stability analysis during percutaneous fixation of calcaneal fractures (Sanders type II B).
- Methodology: Percutaneous fixation and comparison between different screw positioning configurations (superiorly inserted longitudinal screws versus inferiorly introduced screws).
- Key Findings: Longitudinal screws inserted superiorly support the posterior facet significantly better and reduce the plantar movement of the bone fragments [source: 1]. Conversely, inferiorly introduced screws show an association with greater fixation instability.

2. Ivanov, S. Enhancing Antibacterial Performance: Structure, Phase Composition, and Microroughness of Selective Plated Copper Coatings on Medical-Grade Stainless Steel 1.4021 and Nickel Alloy Ni200

- Focus: Investigation of the structural characteristics and biological effects of electrochemically deposited copper coatings on medical-grade stainless steel and nickel alloy.
- Methodology: Electrochemical deposition of copper coatings onto the surface of the tested materials and evaluation of their impact on bacterial cultures.
- Key Findings: The coatings successfully smooth the surface of the materials [source: 1]. The modified surfaces exhibit a strong antibacterial effect, completely halting the growth of the pathogens *S. aureus* and *E. coli*.

3. Ivanov, S. Comminuted intraarticular calcaneal fractures: Multiplanar VA locked plating and interlocked nailing incorporate longitudinal strut and provide superior stability – a biomechanical cadaveric study

- Focus: Comparative analysis of the effectiveness of different fixation methods for severe intraarticular calcaneal fractures.
- Methodology: Comparison between three specific fixation methods: an anterolateral locking plate with additional longitudinal screws, an intramedullary nail, and standard lateral plating.
- Key Findings: The use of an anterolateral locking plate with additional longitudinal screws, as well as the application of an intramedullary nail, provides significantly better stability compared to standard lateral plating.

4. Ivanov, S. A Novel Technique for Treatment of Metaphyseal Voids in Proximal Humerus Fractures in Elderly Patients

- Focus: Evaluates a novel surgical technique utilizing polymethylmethacrylate (PMMA) bone cement augmentation to treat complex proximal humerus fractures (Neer three- and four-part) with metaphyseal defects in elderly patients.

- **Methodology:** A retrospective cohort study analyzed 120 patients divided into three distinct groups: no augmentation (63 cases), autologous bone graft (28 cases), and PMMA cement augmentation (29 cases). The PMMA cement was mixed and allowed to partially cure for 5–7 minutes to achieve medium viscosity before being manually placed into the defect via a traumatic lateral window at a volume of 4–6 mL per patient.
- **Key Findings:** PMMA cement augmentation yielded significantly better short-term functional outcomes—measured via DASH and Constant Scores (CS)—at 3 and 6 months compared to autologous bone grafting when adjusting for age as a covariate. At the 12-month mark, clinical outcomes were statistically equivalent across all groups, despite the PMMA group representing an older patient population with more severe four-part fracture patterns. No severe or specific adverse events were directly linked to the novel cement technique.

5. Ivanov, S. Management of Complex Acetabular Fractures by Using 3D Printed Models

- **Focus:** Investigates the clinical utility and efficiency of physical 3D printed pelvic models for preoperative planning in the surgical management of complex, associated acetabular fractures.
- **Methodology:** A retrospective cohort study compared a conventional planning group (12 patients) against a 3D printed model group (10 patients). Patient CT scan datasets were segmented to fabricate multicolored, fragment-separated physical PLA models used for full visual/tactile assessment, provisional fracture reduction, and preoperative plate contouring.
- **Key Findings:** The 3D printed group achieved a statistically significant reduction in operative time (an average savings of 59 minutes), less intraoperative blood loss (a mean decrease of 172.5 mL), and a massive reduction in the number of intraoperative X-rays required. Additionally, functional recovery at the 17-to-18-month follow-up (using the modified Merle d'Aubigné-Postel score) was significantly better for patients in the 3D printed group.

6. Ivanov, S. Analysis of Complications Following Unicompartmental Knee Arthroplasty

- **Focus:** Evaluates the specific intraoperative errors and long-term postoperative complications associated with unicompartmental knee arthroplasty (partial knee replacement) for isolated knee osteoarthritis.
- **Methodology:** A retrospective study reviewed 450 patients operated on between 2008 and 2018 over a six-year clinical and radiological follow-up period [source: 1]. All surgeries involved the implantation of a fixed-bearing, "all-poly" partial knee endoprosthesis model.
- **Key Findings:** Functional results using the American Knee Society Score (AKS) were highly favorable, yielding excellent or good outcomes in 85% of the patient cohort. The most prevalent intraoperative technical error was the incorrect placement of the femoral condyle entry point (45 patients), which caused varus or valgus component malalignment. Excessive tibial bone resection leading to component subsidence occurred in 12 patients. Postoperatively, the primary complications identified were

osteoarthritis progression in the opposite compartment (10 patients), polyethylene wear (5 patients), and aseptic loosening of the tibial component (4 patients).

7. Ivanov, S. Characterization of allergies – gender, age and blood group structure in a reproductive population from Southern Bulgaria

- **Focus:** The study aims to characterize the manifestation of allergies within a reproductive population in Southern Bulgaria and evaluate potential relationships between these allergic diseases and the demographic factors of gender, age, and ABO/Rh blood groups.
- **Methodology:** The research evaluated individuals aged between 18 and 59 years who voluntarily completed a questionnaire detailing allergy information previously diagnosed by a physician. Participants' ABO and Rh blood types were determined in laboratory conditions using routine techniques, and statistical analyses were performed using the SPSS software package (version 22.0).

Key Findings: Out of the total participants, 20.6% reported suffering from some form of allergy, with a similar initial gender distribution (20.5% in women and 20.8% in men). While allergy occurrence was comparable between sexes up to age 44, a difference emerged in the cohort over 44, where allergies manifested in 17.6% of men compared to 11.9% of women. Allergies were most common in individuals with blood group A (24.0%) and least common in blood group AB (14.7%), with no significant differences found regarding Rh status. The authors concluded that blood group A, as well as the male sex combined with an age over 44 years, could serve as risk predictors for allergies in this population.

8. Ivanov, S. Painful Anterior Knee Schwannoma: A Case Report

- **Focus:** The study presents a rare clinical case of a 37-year-old female patient diagnosed with a painful, slowly growing benign schwannoma (neurilemmoma) located in the anterior aspect of her left knee joint. The focus is to highlight the clinical symptoms, imaging findings, and surgical management of this unusual tumor localization to raise awareness among clinicians and prevent misdiagnosis with common anterior knee pain.
- **Methodology:** A comprehensive clinical examination was performed, followed by diagnostic imaging using echography, radiographs, and Magnetic Resonance Imaging (MRI) to identify the tumor topography. Treatment consisted of a surgical biopsy and complete tumor excision through a standard minimally invasive medial parapatellar approach. The excised tissue was preserved in 10% formalin and evaluated via pathohistological examination and immunohistochemistry (IHC) testing for S-100 protein, followed by a 12-month post-surgery monitoring period.
- **Key Findings:** Preoperative MRI revealed multiple grouped intra- and extracapsular cystic lesions (12 to 38 mm) located supra- and infrapatellarly beneath the patellar tendon, alongside a 13 mm cystic lesion within the patella. During surgery, multiple solitary, encapsulated masses were excised from the subcutaneous tissue and the anterior knee compartment around Hoffa's fat pad. Histopathologic and IHC analyses confirmed a benign schwannoma with diffuse, intensive positive expression of S-100 protein. Postoperatively, the patient became completely symptom-free within two

months, showing no pain or recurrence at 12 months, while fully recovering normal knee range of motion.

9. S., Ivanov, Initial experience with Bulgarian Arthroplasty Register

- **Focus:** To report preliminary findings from the implementation of the OrthoWave™ software suite and the launch of Bulgaria's first joint arthroplasty registry to transition toward statistical, long-term patient follow-up.
- **Methodology:** A clinical database study utilizing the OrthoWave application at the Tsaritsa Joanna University Hospital (ISUL), analyzing 215 patients who underwent 218 total joint replacements (145 hips, 73 knees) between November 2022 and August 2023. Tracked parameters included demographic indicators and specific surgical/implant characteristics.
- **Key Findings:**
 - *Demographics:* The cohort had a mean age of 66.11 years and a mean BMI of 29.3 kg/m². Males predominated in hip replacements (61.38%), while females predominated in knee replacements (58.9%).
 - *Surgical Parameters:* Average operative time was 38 minutes for hip arthroplasty and 49 minutes for knee arthroplasty.
 - *Implants & Approaches:* Cementless fixation was used in 72% of hip surgeries, with the lateral-transgluteal approach being the most frequent (114 cases). For knees, all cases used a medial parapatellar approach, utilizing posterior-stabilized implants in 63% of patients and cruciate-retaining designs in 37%.

10. Ivanov, S. Treatment of Metaphyseal Defects in Plated Proximal Humerus Fractures with a New Augmentation Technique—A Biomechanical Cadaveric Study

- **Focus:** Evaluating the biomechanical stability of a new augmentation technique for treating unstable three-part proximal humerus fractures (PHFs) with metaphyseal defects using locked plating combined with polymethylmethacrylate (PMMA) bone cement.
- **Methodology:** Sixteen paired human cadaveric humeri (mean age 76 years) were split into a control group (locked plating only) and an augmented group (locked plating with PMMA cement). A three-part unstable proximal humerus fracture (AO/OTA 11-B1.1) with a metaphyseal defect was surgically created. In the augmented group, 6 mL of medium-viscosity PMMA bone cement was manually filled into the humeral head defect prior to final fixation with a short PHILOS plate. The constructs underwent progressively increasing cyclic axial loading at 2 Hz in a 25° adduction setup until failure.
- **Key Findings:** Initial stiffness showed no significant difference between the two groups. However, the augmented group demonstrated significantly smaller varus deformation, less fracture displacement at the medial aspect, and minimized proximal screw migration and cut-out after 2,000 to 10,000 cycles. Screw bending in plate row C was significantly reduced, and both the cycles to failure (5° varus deformation) and the

ultimate failure load were significantly higher in the augmented group compared to the control group.

11. Ivanov, S. Kinesitherapy in Motorcycle Racers with Polytrauma

- **Focus:** To evaluate the effectiveness of an individualized kinesitherapeutic rehabilitation program for the functional recovery and quality of life improvement of motorcycle racers who sustained polytraumatic injuries, specifically including "open-book" pelvic fractures ("fuel tank syndrome").
- **Methodology:** A clinical study tracking the rehabilitation process of four motorcycle racers recovering from polytrauma with "open-book" pelvic fractures. Patient evaluation was conducted using objective functional and psychological metrics, including Manual Muscle Testing (MMT), joint goniometry, the Visual Analogue Scale (VAS) for pain tracking, and the World Health Organization Quality of Life questionnaire (WHOQOL-BREF) analyzed via statistical methods.
- **Key Findings:** Following the individual kinesitherapy program, patients demonstrated a statistically significant improvement in their overall quality of life self-assessment across all four monitored domains, with the strongest positive impact observed within the "physical" domain. The therapeutic intervention achieved a marked reduction in physical pain as confirmed by the VAS data, alongside objective functional gains documented by improvements in joint goniometry and MMT scores. The study concludes that the specialized kinesitherapeutic protocol successfully restores self-sufficiency in activities of daily living (ADL) and work-related tasks, facilitating a safe return to everyday activities and the potential renewed practice of motorcycling sports.

12. Ivanov, S. Navigated Total Knee Replacement – Our Physiotherapy Experience in the Early Postoperative Period

- **Focus:** To explore the clinical benefits and efficacy of targeted physical therapy protocols for patients recovering from navigated total knee arthroplasty (TKA).
- **Methodology:** A clinical study tracking ten patients of both sexes (aged 18 to 80 years) who underwent computer-navigated total knee replacement and consequently presented with postoperative edema and joint contracture. Patient progress was monitored across three distinct time points using standardized assessment tools, including the Knee Injury and Osteoarthritis Outcome Score (KOOS) questionnaire, lower extremity circumference measurements, range of motion (ROM) goniometry, and the Visual Analogue Scale (VAS) for pain intensity.
- **Key Findings:** The integration of restorative physical therapy following navigated TKA led to a statistically significant reduction in knee joint girth measurements (edema) and a marked decrease in subjective pain levels on the VAS. Furthermore, the protocol achieved a substantial reduction in joint contracture alongside an objective increase in knee ROM. The study concludes that pairing advanced computer-assisted surgical navigation with early physical rehabilitation is essential for securing rapid, optimal, and sustainable functional recovery.

13. Ivanov, S. Long Term Rehabilitation Results in Patients with Orthopedic Implants of the Upper and Lower Extremities

- **Focus:** To analyze and compare the therapeutic effects of applying two different advanced physical therapy modalities (combined with kinesitherapy) in patients recovering with orthopedic implants of both the upper and lower extremities.
- **Methodology:** A clinical comparative study conducted with a cohort of 240 patients who met the specific inclusion criteria after receiving orthopedic implants. Patients were categorized based on implant anatomical area and the presence of joint contracture, then randomly assigned to one of two treatment protocols: either kinesitherapy combined with Multiwave Locked System (MLS) laser therapy, or kinesitherapy combined with deep oscillation treatment. Outcomes were evaluated across five follow-up periods using functional status questionnaires, limb circumference measurements, joint goniometry (ROM), and pain tracking via the Visual Analogue Scale (VAS).
- **Key Findings:** Patients across all eight designated sub-groups demonstrated significant short- and long-term improvements, showing marked reductions in spontaneous pain on the VAS, decreased edema, and enhanced ROM alongside improved functional status scores. A direct comparative analysis between the two advanced modalities (MLS laser vs. deep oscillation) revealed no statistically significant difference in efficacy, as both protocols yielded equivalent high-quality recovery outcomes. Ultimately, integrating Deep Oscillation or MLS laser therapy into public health frameworks significantly improves symptomatic management for implant patients, safely bypassing the standard contraindications of traditional electrotherapy for metal hardware, shortening forced immobilization periods, and preventing postoperative complications.

14. Ivanov, S. The Effects of a Physiotherapeutic Complex in Patient with Post-Traumatic Stiff Elbow

- **Focus:** To investigate the clinical possibilities of treating and preventing post-traumatic elbow stiffness and contracture using modern physiotherapeutic methods.
- **Methodology:** A case study of a 63-year-old female patient with a fractured distal humerus and olecranon process, surgically stabilized via medial/dorsolateral locking plates and Webber osteosynthesis. Following 30 days of soft postoperative immobilization, she underwent a specialized 7-day rehabilitation protocol combining Multiwave Locked System (MLS) laser therapy and kinesitherapy techniques. Clinical outcomes were tracked at baseline (Day 1/T1) and post-treatment (Day 7/T2) using range of motion (ROM) goniometry, localized swelling, the Visual Analogue Scale (VAS) for pain, and the Mayo Elbow Performance Index (MEPI).
- **Key Findings:** The initial examination (T1) revealed significant swelling, restricted ROM, and pain at the end-range of motion. Following the 7-day treatment cycle (T_2), the patient demonstrated substantial improvements across all indicators, characterized by reduced elbow contracture and swelling, an increased range of flexion, better VAS pain scores, and enhanced functional outcomes via higher MEPI scores. The study concludes that managing challenging postoperative elbow contractures with orthopedic implants benefits greatly from integrating advanced physical modalities like MLS laser therapy to accelerate functional recovery.

15. Ivanov, S. Role of Polymorphonuclear Neutrophil Leucocyte Count in Joint Aspirate for Diagnostics of PJI

- **Focus:** To investigate and present the relationship between an increased polymorphonuclear neutrophil leukocyte (PMN) count in synovial fluid and the presence of low-grade periprosthetic joint infection (PJI), aiming to evaluate its role as a diagnostic marker in an increasing global number of arthroplasties.
- **Methodology:** A clinical diagnostic study conducted at the Department of Orthopedics and Traumatology at the University Hospital "St. Marina" in Varna. The study evaluated 19 patients presenting with suspected clinical and uncertain radiological signs of periprosthetic joint infection. PMN counts in the synovial fluid were analyzed and compared across three designated cohorts: patients with suspected infected arthroplasties, patients with degenerative arthritis, and patients with rheumatoid arthritis (RA) serving as the control group.
- **Key Findings:** The analysis established a significant relationship between an increased polymorphonuclear neutrophil leukocyte count in the synovial fluid and the confirmed presence of periprosthetic joint infection. The results indicate that the PMN count functions as a highly sensitive and valuable marker for PJI, proving critical for securing an accurate preoperative diagnosis, optimizing subsequent surgical/medical treatment planning, and ensuring superior long-term functional recovery results for patients.

16. Ivanov, S. Role of Sonication in PJI

- **Focus:** To evaluate and compare the diagnostic efficacy of standard tissue cultures (STC) versus sonication fluid cultures (SFC) obtained from extracted metal implants in patients with suspected low-grade periprosthetic joint infections (PJIs) to improve pathogen isolation rates.
- **Methodology:** A clinical comparative diagnostic study conducted at the "Saint Marina" University Hospital in Varna, Bulgaria, evaluating a cohort of 19 patients who underwent revision arthroplasty surgery for PJI. Diagnostic samples were concurrently harvested and tested using three distinct methods: standard tissue cultures, joint aspiration fluid cultures, and sonication fluid cultures from the extracted metal hardware. Three patients with completely negative pathogen isolation across all testing modalities served as a confirmed aseptic loosening control sub-group.
- **Key Findings:** The analysis revealed that sonication fluid cultures demonstrated a superior pathogen isolation rate of 93.75%, markedly outperforming standard tissue cultures (50%) and aspiration fluid cultures (25%). A 100% bacterial concordance was observed whenever microbial growth was simultaneously present in both the standard tissue and sonication fluid cultures. The study concludes that while standard tissue cultures remain the diagnostic gold standard, sonication fluid culture offers crucial added value to the diagnostic algorithm—effectively identifying the causal low-grade microorganism in cases where standard tissue and aspiration fluid cultures return false-negative results due to bacterial biofilms on the metal implants.

17. Ivanov, S. Functional Outcomes from the Early Postoperative Period in Patients Undergoing 3D Preoperatively Planned and Computer-Navigated Total Knee Arthroplasty

- **Focus:** To compare the early postoperative functional recovery outcomes between two modern surgical approaches in knee replacement: 3D preoperatively planned knee arthroplasty versus computer-navigated knee arthroplasty.
- **Methodology:** A comparative clinical study evaluating two distinct cohorts of patients, consisting of 10 patients who underwent 3D preoperatively planned knee arthroplasty and 10 patients who underwent computer-navigated knee arthroplasty. All 20 patients received specialized, structured postoperative physiotherapy protocols and targeted physical treatments. The functional outcomes and clinical recovery were recorded and assessed using the Visual Analogue Scale (VAS) for pain intensity, the Oxford Knee Score questionnaire for joint function, and standardized goniometric methods to measure the range of motion (ROM) in the affected knee joint.
- **Key Findings:** Following data analysis, patients in the computer-assisted (navigated) knee arthroplasty cohort demonstrated superior functional indicators and better overall recovery parameters during the early postoperative phase compared to the 3D preoperatively planned group. The study concludes that combining advanced computer-assisted surgical navigation with a specialized, early physical therapy protocol leads to significantly enhanced rehabilitation results, minimized postoperative limitations, and optimal early-stage recovery for arthroplasty patients.

18. Ivanov, S. Biomedical Characteristics and Evaluation of Chitosan, Bioactive Glass and Laponite®/BMP-2 as Surface Implant Coatings: A Systematic Review

- **Focus:** To analyze and evaluate the biomedical characteristics of Chitosan, Bioactive glass, and Laponite®/BMP-2 as potential advanced substances for implant surface coatings aimed at improving tissue osseointegration, managing bone loss, and enhancing implant durability and survival in orthopedic, traumatology, and dental practices.
- **Methodology:** A comprehensive literature review and search for scientific studies conducted across the Google Scholar and PubMed electronic databases covering a ten-year period (2014–2024). The search strategy utilized targeted combinations of keywords, including: Biomedical characteristics, Chitosan, Bioactive glass, Laponite (BMP-2), and implant surface coatings.
- **Key Findings:** The reviewed literature demonstrated that Chitosan, when utilized as an implant coating material, successfully promotes osseointegration across both *in vitro* and *in vivo* models. Surface coatings composed of Bioactive glasses were found to improve overall implant stability while strengthening the foundational connection between the coating layer and the implant structure. Furthermore, integrating the inherent biocompatibility of Laponite® with the potent osteoinductive properties of Bone Morphogenetic Protein-2 (BMP-2) as a combined surface coating enhances the healing of localized bone defects and significantly accelerates the rate of osseointegration. The study concludes that these bone substitutes provide valuable

clinical guidance for optimizing implant longevity and structural durability in both orthopedic surgery and periodontal treatments.

19. Ivanov, S. 3D Printed Anatomical Models for Preoperative Planning of Complex Orthopaedic Surgical Operations of the Lower Limb

- Focus: To describe the methodology of fabricating high-fidelity 3D-printed anatomical bone models from CT data and evaluate their clinical impact on preoperative planning for complex, high-energy pelvic and lower limb fractures.
- Methodology: 3D skeletal models were generated from patient CT scans using open-source software (3D Slicer) and fabricated via FDM 3D printing with Polylactic Acid (PLA). These physical replicas allowed surgeons to select surgical access, prepare tools, and pre-bend (contour) metallic fixation plates prior to surgery [source: 1]. Intraoperative outcomes—including operation time, blood loss, X-ray exposure, and the quality of anatomical reduction—were tracked across complex hip, knee, and ankle cases.
- Key Findings: Utilizing 3D-printed models provides a highly personalized approach that yields excellent anatomical reduction and favorable functional outcomes for challenging fractures (pelvis, acetabulum, tibial plateau, and calcaneus). The method significantly reduces operation duration, intraoperative blood loss, and radiation exposure while lowering post-surgical complication rates. Additionally, this protocol establishes a baseline for the future implementation of patient-specific 3D-printed titanium implants.

20. Ivanov, S. Fingertip traumatic amputations in children. Treatment with semiocclusive foil dressings-preliminary results

- Focus: To evaluate the clinical efficacy and advantages of treating traumatic fingertip amputations in children using semi-occlusive foil dressings as a conservative, minimally invasive approach.
- Methodology: A clinical study tracking 6 pediatric patients (aged 8 to 15 years) presenting with fingertip amputations of the hand. The therapeutic protocol utilized semi-occlusive dressings changed once per week over an average treatment duration of 3 to 4 weeks, followed by the application of epithelializing ointments to the wound margins after final dressing removal. Clinical outcomes were assessed based on treatment duration, dressing frequency, cosmetic shape of the pulp, joint contractures, and tactile sensitivity measured via the two-point discrimination test.
- Key Findings: The healing process achieved complete closure within an average of 20 to 30 days, requiring only 3 to 5 dressing changes throughout the entire treatment cycle. Upon completion, patients demonstrated excellent cosmetic outcomes with a normally shaped finger pulp, no contractures in adjacent joints, and an optimal average two-point discrimination value of 2.5 mm. The study concludes that semi-occlusive dressing therapy is a simple, low-pain, minimally invasive technique ideally suited for the pediatric population, though it requires active cooperation from both children and parents.

21. Ivanov, S. Comparative Evaluation of the Application of Platelet Rich Plasma (PRP) in Orthopedic Ambulatory Practice for Treatment of Tendon Diseases by Innovative Obtaining Method

- **Focus:** To discuss the pathological features of tendinosis (overload-induced tendon diseases) and evaluate the mechanisms of conservative treatment methods—specifically comparing the clinical application of local corticosteroids with Platelet-Rich Plasma (PRP) therapy for elbow enthesopathy.
- **Methodology:** A clinical review and analysis focusing on the management of common tendinopathies affecting the medial/lateral elbow epicondyles, patella, rotator cuff, and Achilles tendon. The study contrasts the standard clinical use of local corticosteroids against advanced biologic interventions like PRP therapy, examining how these modalities interact with the underlying degenerative and hypovascular structural changes that compromise tendon strength and predispose them to rupture.
- **Key Findings:** While local corticosteroid injection remains the most frequent conservative method for elbow enthesopathy in clinical practice, it addresses a condition fundamentally characterized by degenerative, dystrophic changes and hypovascularization. In contrast, PRP therapy works by significantly increasing the local concentration of growth factors at the injury site. This biophysical cascade induces a controlled inflammatory response that actively stimulates angiogenesis and neovascularization within the tendon tissue, offering a regenerative pathway to restore structural integrity and mechanical strength.

22. Ivanov, S. Operative Treatment of Scapular Neck Fractures

- **Focus:** To outline the anatomical and clinical considerations of scapular neck fractures—which typically result from high-energy trauma and present a high risk of associated injuries—and to introduce a novel operative osteosynthesis technique aimed at preventing degenerative joint disease, pain, and instability.
- **Methodology:** The clinical management and diagnostic evaluation of extra-articular scapular neck fractures were analyzed using plain radiographs, conventional CT scans, and three-dimensional CT reconstructions. Key structural parameters were assessed to characterize fracture displacement, including medial/lateral displacement, angulation, translation, glenolar version, and the glenopolar angle. Surgical intervention was performed utilizing posterior approaches, executing plate osteosynthesis along the lateral border of the scapula.
- **Key Findings:** While nonoperative treatment of these extra-articular injuries sometimes yields positive outcomes, it can also lead to unfavorable clinical results. To optimize recovery, this study introduces a new surgical technique featuring fragment fixation using a volar fixed-angle contralateral locking T-plate designed for the distal radius. Due to the minimal fracture displacement and rapid healing supported by the rich blood supply of the 18 different muscles anchoring the scapula, this specialized locking-plate technique along the lateral border results in excellent long-term functional recovery and stable shoulder girdle coordination.

23. Ivanov, S. Tibial Plateau Fractures – Open Reduction and Internal Fixation

- **Focus:** To analyze the surgical strategies and biomechanical principles required for the treatment of heterogeneous tibial plateau fractures, emphasizing techniques that minimize soft tissue damage and post-traumatic knee stiffness.
- **Methodology:** The clinical and biomechanical management of various tibial plateau fracture types was evaluated. Low-energy lateral compression fractures (split and split-depression variants) were addressed via a single-incision anterolateral approach utilizing cannulated lag screws, buttress plates, or locking compressive plates. Conversely, highly unstable, high-energy bicondylar fractures involving serious soft tissue and musculo-ligamentous damage were managed using direct reduction and bilateral plating techniques to secure structural stability.
- **Key Findings:** Due to severe intra-articular bleeding and ligamentous lesions, minimizing immobilization time is critical to prevent rapid post-traumatic joint stiffness. Achieving this requires early osseous restoration with high biomechanical stability to allow immediate passive motion training. The study concludes that successful outcomes depend on strictly adhering to the core principles of anatomical reduction, rigid internal fixation, and early mobilization, rather than oversimplifying care with a single stabilization technique for all fracture types.

24. Ivanov, S. Analysis of Existing Classifications of Platelet-Enriched Plasma Concentrates (PRP)

- **Focus:** To analyze existing classification systems for platelet-enriched concentrates (commonly generalized as platelet-rich plasma or PRP) in order to address the scientific confusion caused by variations in their physicochemical characteristics and cellular composition.
- **Methodology:** A comprehensive literature review evaluating current classification models for platelet concentrates. The analysis focused on four critical parameters: leukocyte content, the exact concentration of platelets, the activation mechanisms, and the structural density of the fibrin mesh.
- **Key Findings:** The study reveals that the general term "PRP" is incomplete due to extensive procedural variations in preparation, activation times, and delivery methods (such as *in vitro* activation versus *in vivo* induction by local tissue factors). These inconsistencies lead to highly variable biological efficacy and a lack of clinical consensus. The study concludes that precise quantification of cellular components is essential for reliable product validation, and that adopting a more specific, streamlined classification system is critical for successfully matching platelet concentrates to their intended clinical applications.

25. Ivanov, S. Modified Hybrid Technique for the Treatment of Distal Achilles Tendon Avulsions

- **Focus:** To present a minimally invasive modified hybrid surgical technique for treating distal Achilles tendon avulsions and to evaluate its post-operative clinical outcomes.
- **Methodology:** A retrospective analysis of 9 patients presenting with distal Achilles tendon avulsions, specifically targeting cases where the remaining distal stump of the tendon was extremely small or where a true bony avulsion had occurred. Patient

recovery and functional outcomes were evaluated using the Visual Analogue Scale (VAS) for pain and the American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot score.

- **Key Findings:** The modified hybrid surgical technique successfully restored joint function while minimizing surgical trauma. Follow-up evaluations revealed excellent clinical metrics, demonstrating a low mean post-operative pain score (VAS = 1.5) and a high mean functional recovery score (AOFAS = 90.6). The study concludes that this minimally invasive method carries a low risk of complications, accelerates patient recovery, and enables a swift return to daily activities, making it a highly viable operative option for challenging distal avulsions.

26. Ivanov, S. Treating Distal Fingertip Traumatic Amputations with Semi-Occlusive Foil Dressings—Preliminary Results

- **Focus:** To evaluate the clinical effectiveness, safety, and functional outcomes of a novel conservative technique utilizing semi-occlusive foil dressings for the treatment of traumatic distal fingertip injuries and amputations.
- **Methodology:** A prospective clinical study evaluating 15 adult patients presenting to the emergency department with distal fingertip injuries resulting from blunt-force or sharp-object trauma. The treatment protocol involved the application of semi-occlusive foil dressings, which were changed weekly for a duration of 3 to 4 weeks, completely omitting antibiotic therapy. Patients were instructed to fully utilize the injured finger during the healing phase and, upon granulation of the fingertip, to apply epithelializing unguents to the adjacent intact skin [source: 1]. Patients were followed up for 4 months to assess range of motion (ROM), cosmetic appearance, and sensory restoration.
- **Key Findings:** The semi-occlusive foil dressing regimen enabled an exceptionally fast return to physical activity—just 1 to 3 days post-injury—while eliminating the need for complex flap plastic reconstructions. At the 4-month follow-up, all patients demonstrated full ROM, complete sensory restoration, and an excellent cosmetic outcome, with the finger pulp successfully regaining its normal shape, bulk, and size. The study concludes that this technique is a fast, simple, cost-effective, and highly reliable alternative for managing traumatic fingertip amputations in emergency settings.

Abstracts of full-text publications in scientific journals and proceedings by Stoyan Ivanov, MD, PhD, beyond the minimum scientometric requirements for the academic position of „Associate Professor“

1. Ivanov, S. An Approach to the Creation of a Computational Model of a Trabecular Bone

- Focus: Development of a realistic three-dimensional computational trabecular bone model for osteoporosis research, medical imaging simulation, and 3D printing.
- Methodology: Patient CT data of the tibia were combined with sphere-based fractal geometric primitives to generate voxelized trabecular bone structures. Four computational bone models with different trabecular textures were created and evaluated through simulated X-ray imaging and expert orthopedic assessment.
- Key Findings: The proposed modeling approach successfully generated realistic trabecular bone architecture that was positively evaluated by orthopedic specialists. The models demonstrated potential applications in osteoporosis research, surgical planning, implant testing, biomechanical simulations, medical education, and the development of advanced X-ray and CT imaging techniques.

2. Ivanov, S. Optimizing Subtalar Arthrodesis: A Human Cadaveric Evaluation of a Novel Partially-Threaded Screw Combination in the Delta Configuration

- Focus: Biomechanical evaluation of a novel screw combination for subtalar joint arthrodesis using the delta screw configuration.
- Methodology: Human cadaveric lower limbs were instrumented with either two cannulated compression screws (CCSs) or a combination of one posterior cannulated compression headless screw (CCHS) and one anterior CCS. Constructs underwent progressively increasing cyclic loading while talocalcaneal motion was monitored.
- Key Findings: The combination of a posterior CCHS and an anterior CCS provided significantly greater biomechanical stability by reducing varus–valgus deformation and rotational movement compared with the conventional two-CCS construct. This configuration may also reduce hardware irritation while maintaining stable fixation and potentially shortening surgical time.

3. Ivanov, S. Types of Bone Substitutes and Their Application in Regenerative Medicine: A Systematic Review

- Focus: Comprehensive systematic review of biological, mechanical, and clinical characteristics of bone substitutes used in regenerative medicine.
- Methodology: Systematic review conducted according to PRISMA guidelines, analyzing 68 high-quality publications (2019–2025) from PubMed, Scopus, Web of Science, and Google Scholar. The review compared autogenous, allogeneic,

xenogeneic, and synthetic bone substitutes regarding their osteogenic, osteoinductive, osteoconductive, and clinical performance.

- Key Findings: Autogenous bone grafts remain the gold standard due to their superior osteogenic potential, whereas allogeneic and xenogeneic grafts provide structural support but require extensive processing to ensure safety. Synthetic calcium phosphate-based substitutes demonstrate excellent biocompatibility and controlled degradation, with β -tricalcium phosphate showing favorable long-term performance. The review emphasizes that personalized selection of bone substitutes and the development of hybrid biomaterials are essential for optimizing regenerative outcomes.