

The Hip is the Most Stressed Joint in the Human Body

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ABSTRACT

The hip joint is a complex network of bones, cartilage, muscles, ligaments and tendons that must work as one unit. It is one of the most stressed joints in the human body and allows walking, sitting, bending and turning the leg without pain. The hip is a very stable joint consisting of a spherical part at the top of the femur that enters the concave articular body, the cup, which makes up the bones of the pelvis. Both joint bodies are connected by ligaments that form the joint capsule and together with the position of the bony parts are responsible for the stability of the joint. The articular bodies, head and cup, are covered with a layer of smooth tissue called cartilage. A capsule surrounds the fluid-secreting joint. This fluid lubricates the joint, further reducing friction and facilitating movement. The most common causes of hip pain are: osteoarthritis, rheumatoid arthritis, osteoporosis, injuries, infections and bone tumors.

Keywords: Hip; Hip Implant; Pelvis; Pain; Health

Abbreviations: CAD: Computer-Aided Design; RA: Rheumatoid Arthritis; TED: Thromboembolic Disease; DVT: Deep Venous Thrombosis; PT: Prothrombin Time; EDM: Electric Discharge Machining; PMEDM: Powder Mixed Electric Discharge Machining; SWCNTS: Single-Walled Carbon Nanotubes; MWCNTS: Multi-Walled Carbon Nanotubes; THA: Total Hip Arthroplasty; THR: Total Hip Replacement; UHMWPE: Ultra-High Molecular Weight Polyethylene; PLA: Polylactic Acid; FEA: Finite Detail Evaluation

Introduction

The primary function of the lower extremities is locomotion [1]. Any alteration of the characteristic of the lower extremities will bring about an alteration within the capacity to stroll and run. The hip is the maximum proximal joint within the lower extremity. Alteration within the hip because of disorder will appreciably have an effect on the biomechanics of gait and vicinity unusual pressure at the joints above and under the hip, that can cause ache in regions inclusive of the lumbar backbone and the knee. The designed hip implants range in geometry with distinctive geometrical parameters [2]. The geometry performs a vital function within the mechanical conduct of the hip implant. The most effective choice of hip implant beneath static loading become evaluated the use of Finite Element Modeling (FEM). Hip implants with 3 distinctive stem move-sections which includes

- (a) Elliptic,
- (b) Oval, and
- (c) Trapezoidal have been designed the use of a commercial Computer-Aided Design (CAD) software program package. The FEM evaluation become done through ANSYS R2019 to evaluate the important thing mechanical parameters of the implants inclusive of pressure distribution and deformation. The effects have been evaluated for the first-rate pressure and stress values. The most effective layout had equal pressure (von Mises) of 258,1 MPa, equal stress of 0.004, with overall deformation of 0.24 mm and frictional pressure of 0.362 MPa generating first-rate values for trapezoidal move-sectioned layout.

Pelvis

The pelvis is fashioned via way of means of the 2 innominate bones that articulate posteriorly on the sacrum and anteriorly on the pubic symphysis [3]. These attachments shape the pelvic girdle, which hyperlinks the axial skeleton to the lower extremities of the frame. Each innominate bone is formed via way of means of the fusion of the ischium, ilium, and ischium that takes place throughout puberty. The fusion of those 3 bones forms cup-shaped, anteverted (15°) acetabulum that articulates with the pinnacle of the femur to shape the diarthrodial hip joint. Pelvic articulations have restricted intrinsic balance. Instead, key ligaments of the posterior, anterior, and pelvic ground complicated offer balance to the pelvis and resist deforming stresses. The complicated includes the sacroiliac and iliolumbar ligaments that save you nutation and counternutation and are a number of the most powerful ligaments withinside the frame. The anterior complicated consists of the fibrocartilaginous pubic symphysis and resists outside rotation. The pelvic ground complicated consists of the sacrospinous ligament that resists outside rotation and the sacrotuberous ligament that resists shear and flexion. The hip has conferred balance from the bony articulation of the femoral head withinside the acetabulum. Additionally, the fibrocartilaginous labrum will increase the acetabular depth, and gives an attachment site for the adjoining ligaments, growing joint balance. Finally, the hip pill composed of the iliofemoral, ischiofemoral, and pubofemoral ligaments contributes to the stableness of the hip joint. The iliofemoral ligament is the most powerful of the 3 ligaments and resists anterior dislocation and hyperextension. The ischiofemoral ligament, the best ligament placed withinside the posterior hip, resists immoderate inner rotation, extension, and posterior translation. Finally the pubofemoral ligament at the anterior component of the hip resists immoderate abduction and extension.

Pain

The maximum vital preliminary step at the same time as acquiring the affected person's scientific records is to invite the affected person to factor to the vicinity of "hip pain" [4]. Most will factor to their lower back or their lateral thigh, now no longer their groin. In general, hip pain is groin pain. Patients with proper hip ache normally complain of trouble of hip movement, a painful limp, and pain withinside the groin on movement. Pain takes place much less regularly at relaxation and infrequently at night time. Care at the same time as acquiring the affected person's scientific records can also additionally monitor early life hip problems, inclusive of Legg-Calvé-Perthes disorder, slipped capital femoral epiphysis, developmental dysplasia of the hip, and septic arthritis. Concomitant problems inclusive of osteoarthritis, rheumatoid arthritis (RA), psoriatic arthritis or ankylosing spondylitis, malignancy, or low lower back pain can also additionally offer perception into the etiology of the hip pain. A records of alcohol or steroid use is pertinent in sufferers suspected of getting

osteonecrosis. Response to earlier therapies, which includes bodily remedy, anti-inflammatory medications, amendment of interest, night time pain, or use of assistive devices allows one to evaluate the severity of the pain. Accompanying fever, chills, weight loss, or fatigue, or a records of new contamination are vital signs that would replicate an inflamed hip or metastatic lesion. The assessment of a affected person with hip ache calls for cautious interest to the records, bodily examination, and radiographic research [1].

The character, nature, and duration of the affected person's ache have to be documented. Acute or current onset ache will extra usually be related to trauma or contamination. Chronic and gradually innovative ache is related to arthritic conditions. Intra-articular ache is normally defined as a deep, aching ache. Pain from the hip joint will usually be stated anteriorly withinside the groin or posterior to the extra trochanter. Hip pain can radiate down the internal and anterior thigh to the knee with very little ache withinside the vicinity of the hip. Only hardly ever will hip pain radiate distal to the knee. In adolescent sufferers, it is now no longer unusual for hip pathology to offer as knee ache. Therefore a thorough bodily and radiographic assessment of the hips is important to discover the pathology in those sufferers. Posterior ache and buttock ache is extra usually related to lumbar spine pathology. Spine ache will also extra usually radiate down the posterior thigh and under the knee. The insidious onset of a deep dull ache, and ache that awakens the affected person at night time, shows both contamination or neoplastic disorder. Hip pain is usually annoyed via way of means of interest and relieved via way of means of relaxation. Patients will record trouble wearing and doffing their footwear and socks and trouble with toenail care at the concerned extremity. As the ache progresses, sufferers will start to have ache with extended sitting and at night time as they are trying to sleep. Patients with hip arthritis will record that in the event that they take a seat down for a extended period of time after which stand up to stroll, the hip feels out of vicinity or painful for the first few steps. This feeling normally will remedy speedy after some minutes of walking.

Complications

The maximum common trouble after THR is thromboembolic disease (TED) [1]. This consists of deep venous thrombosis (DVT) and pulmonary embolism. Early withinside the records of THR, the charge of deadly pulmonary embolism become 1–2%. However, at that time sufferers have been stored on mattress relaxation for so long as 2–three weeks and stored as much as 6 weeks withinside the clinic. Early mobilization of sufferers has undoubtedly contributed to the huge discount withinside the charge of deadly pulmonary embolism. However, huge reduction has additionally happened via using anticoagulant prophylaxis, nearby anesthesia, shorter working times, and decrease blood loss. In the United States, THR is taken into consideration a huge chance thing for TED and consequently the recurring use of scientific and/or mechanical

prophylaxis has been encouraged. At present, the charge of TED tiers among 5 and 20%. The charge of deadly pulmonary embolism is low, about 0.01%. The foremost strategies of prophylaxis are low-dose Coumadin (warfarin), aspirin, low molecular weight heparin, and pneumatic compression stockings. Coumadin is began out the nighttime previous to surgical operation or at the day of surgical operation. It is encouraged that the remedy be persevered for three–6 weeks postoperatively. The medicine desires to be monitored intently to preserve the extent inside a secure variety. The worldwide normalized ratio (INR) is centered at about 2.0. It has been proven in lots of research to be a secure and powerful approach of prophylaxis.

However, the tracking of Coumadin is of precise concern. Occasionally sufferers could have a dramatic elevation in their prothrombin time (PT) and INR with the primary dose. This will cause a chance of post-operative bleeding and hematoma on the operative site. As the duration of live withinside the clinic has reduced to three–four days or much less, this has made using Coumadin more and more more hard. It often will take 5–7 days to get a affected person equilibrated on a regular dose of Coumadin. This is extra hard to accomplish withinside the outpatient setting. Currently that is controlled with using home nursing offerings and common tracking.

EDM

Electric discharge machining (EDM) in current decades, has been taken into consideration because the maximum exploited non-traditional machining tactics [5]. Herein, electric energy is converted into warmness power among the tool and the workpiece, applied for fabric elimination. Widespread programs of EDM will be witnessed withinside the automobile, aviation, and scientific domain. In this thermoelectric technique, fabric erosion is due to each the electrodes (device and workpiece) throughout the spark generation. A aggressive floor topology and accuracy may be carried out via way of means of EDM in comparison to different traditional machining strategies. The super capacity of machining with EDM has been tested with increased strength, better floor hardness, and formation of intermetallic compounds on the floor. Titanium alloys have been extensively utilized in aerospace in addition to biomedical enterprise because of their salient physiomechanical and biocompatible attributes. Ti-6Al-4V ($\alpha\beta$) phase alloy is the maximum desired steel Ti alloy withinside the biomedical programs. However, the presence of vanadium in those alloys except occupancy of amino acids and proteins in frame fluids promotes the corrosive action. This mechanism induces negative osseointegration that results in cytotoxicity and different allergic reactions and in the long run failure of the implant. Still, using Ti-6Al-4V alloy has been witnessed because of its admirable human frame favorable features.

Subsequently, for extended advanced adhesion among steel, bone and tissue enhancement of floor traits of the Ti alloy is of

maximum significance. Powder mixed electric discharge machining (PMEDM) is one of the current development in fabric elimination tactics hired to reinforce the machining capacity and floor traits. It has been explored that using nano-powder debris withinside the dielectric complements the release frequency and improves the fabric elimination charge in addition to floor quality. Rolling of the graphene sheets into nano-diameter cylinders effects in carbon nanotubes (CNTs). CNTs are available in variants, particularly single-walled carbon nanotubes (SWCNTs) and Multi-walled carbon nanotubes (MWCNTs). These own unmatched electrical, mechanical, and thermal houses and as a consequence have a brilliant destiny in biomaterial implants. CNTs proved to be an splendid substrate fabric for implants, mobileular cultivation supplying advanced mobileular proliferation and adhesion. CNTs were observed non-poisonous at positive concentrations at the titanium floor and inhibit advanced mobileular boom and bone nodule formation. CNTs bestow a nicely ordered and regular molecular structure, making sure super features that encompass better tensile strength, component ratios, and electrical conductivity. In current times, improvements in synthesis, purification, and functionalization of CNTs have better its distinctive feature in addition to its biocompatibility and are presently being actively explored as a cloth for destiny bioimplant coatings, composite biomaterials, and biosensors.

THA

Total hip arthroplasty (THA) is one the maximum a hit surgical procedures in contemporary-day era due to the general marked development of the affected person's characteristic and quality of life [6]. Once a surgical intervention has carried out a positive fashionable of efficacy and reproducibility, similarly tendencies may be positioned on minimizing the morbidity of the intervention. Less invasive surgical strategies in addition to multimodal pain control have additionally advanced during the last decade withinside the subject of joint replacements, particularly THA, allowing sufferers to doubtlessly recover quicker in addition to optimize their usual characteristic via way of means of keeping off immoderate muscle dissection. As with any new surgical technique, preliminary enthusiasm become primarily based totally on excessive affected person expectancies in addition to physician enthusiasm however, as is all too not unusualplace in surgical operation, over enthusiasm cause a few extreme headaches.

THR

Total Hip Replacement (THR) surgical operation is often implemented while hip joints lose their functionality [2]. To reach changing a brand new hip prosthesis, along the appropriate surgical operation strategies, the implant have to fulfill the necessities to healthy for the cause via way of means of showing anticipated biomechanical behaviors inclusive of most effective strength, put on resistance, osseointegration, and biocompatibility, etc.. Stress distribution and deformation are the number one elements taken into consideration withinside the implant layout studies to shed

mild at the uniform (in correspondence with pressure protective effect) or unfavorable surprising stressdeformation, that are of notable significance withinside the initial have a look at at the mechanical overall performance of the implants earlier than scientific application. The not unusualplace geometrical variables of the hip implants will be named as follows; stem duration, move-segment type, neck duration, neck perspective and head diameter. Titanium frame steel hip implants are usually used with out cement. The cause for that is that the titanium alloy implant makes an excessive amount of displacement withinside the bone, which reasons the femoral stem element to bend withinside the cement and spoil it. Since Ti-6Al-4V alloy become utilized in the femoral stem element in three distinctive move-segment, cement become now no longer utilized in solving the hip implant into the femur bone.

The implants are designed with the anticipated life of 10 years that can extrade in step with the affected person and their lifestyle. The parameters inclusive of equal pressure, deformation, and friction play a function on this anticipated lifetime, relying at the used substances inclusive of UHMWPE (Ultra-High Molecular Weight Polyethylene), Ti6Al4V, CoCrMo, and stainless steel. Stem layout is an vital component in hip implant assembly. Stem layout calls for optimization and desires to be investigated.

External Fixation

All symptoms for outside fixation are relative—there aren't anyt any absolute symptoms [7]. External fixation use is extraordinarily physician dependent. Some surgeons have precise symptoms for definitive remedy of periarticular fractures in outside fixation. Others hardly ever use this technique, preferring transient frames accompanied via way of means of not on time inner fixation. Clinical use can be restricted in element via way of means of the value as a unmarried articular fracture calls for surgical approaches rather than one, as a consequence appreciably growing overall value for a affected person. The extra critically injured a affected person, with one or extra periarticular fractures, the extra the indication for using a transient jointspanning outside fixation. The fast application; the capacity to keep away from splints or casts, to visualize smooth tissues circumferentially, and to permit smooth tissue approaches; and the relative ease of mobilizing the affected person are all blessings in polytrauma sufferers. The extra extreme the fracture, the extra beneficial the transient joint-spanning frame. Severe comminution, shortening displacement, open wounds, and extreme closed smooth tissue damage are all traits of the damage advantage from joint-spanning frames. The maximum not unusualplace joint to be spanned is the ankle, accompanied via way of means of the knee. Some extreme foot fractures/dislocations can also additionally advantage from spanning outside fixation. In the top extremity the wrist is often spanned and, occasionally, the elbow.

Spanning fixation of the hip or the shoulder is uncommon due to the fact proximal fixation in both of those regions is problematic. Subsequent definitive remedy alternatives encompass definitive outside fixation or inner fixation with plates and screws. Modality of definitive remedy is physician dependent. External fixations of the distal tibia, proximal tibia, and distal radius are the maximum usually applied regions. External fixation can be used to offer move joint help and stabilization, which can also additionally lessen the desired quantity of inner fixation and offer additional joint balance. An outside fixator can be used to offer joint distraction as method to decrease hundreds on articular cartilage and to stimulate fracture recuperation. Articulated move joint outside fixators permit joint mobility at the same time as nevertheless supplying fracture stabilization, with a theoretical advantage of advanced synovial fluid move and advanced variety of movement. The hinge of the frame have to approximate the axis of rotation of the joint.

PLA

Polylactic acid (PLA) is a biodegradable non-poisonous, biocompatible polymer used as a famous filament fabric in biomedical programs with the development of 3-d printing technology [8]. PLA is taken into consideration a appropriate implant fabric because of its contribution to bone regeneration. The use of PLA in Total Hip Arthroplasty (THA) as a liner fabric become assessed. In this regard, the PLA liner with distinctive fabric combos in THA become tested to offer proof for its capacity. The hip implant prototypewas drawn the use of a computeraided layout device then transferred right into a business finite detail evaluation (FEA) software program. The prototypesconsisted of assemblies of PLA with titanium, chrome cobalt, stainless steels, dense NiTi shape-alloys, and Alumina-Zirconia. Simulations have been run beneathneath static loading conditions. To compare and evaluate the effects for the most effective layout; thing of safety, overall deformation and von Mises pressure evaluation have been used. The effects display that Co-Cr applied implants produce the best thing of safety. When Al-Zi blended with PLA, it produced least deformation and affordable von- Mises pressure values. PLA would possibly perform first-rate while used with Al-Zi. As a subsequent step, experimental pre-scientific exams are deliberate to evaluate the scientific capacity. From the beyond to the present, the want for hip implants has been growing, so the look for longer-lasting and inexpensive substances has happened.

UHMWPE is the maximum used fabric as a liner fabric however Polylactic acid (PLA) is used as an opportunity to this fabric and a evaluation is made. PLA is one of those substances that is notion to have the functionality to satisfy those necessities. PLA is a biodegradable fabric derived from renewable reassets inclusive of corn starch or sugar-containing plants. It is produced via way of means of polymerization approach the use of lactic acid and lactide monomers. Polylactic acid (PLA) has been a famous fabric

lately because of the development of 3-d printing technology. PLA is taken into consideration as a promising fabric within the biomechanics subject because of its biocompatible, osteo-integrative, biodegradable houses. In this studies, the capacity of PLA use as a liner in Total Hip Arthroplasty (THA) is investigated. The plastic liner is used to lessen friction and put on in hip implants and positioned among the cup and head parts. One of the maximum vital elements affecting fabric choice is its compatibility with surrounding tissues. Care has been taken to make certain that the selected substances are biocompatible. PLA fabric and UHMWPE, that is often used fabric as a liner, have been as in comparison. Alternative fabric houses have been investigated via way of means of mechanical model. Changes in effects have been found via way of means of the use of distinctive substances beneath the identical mechanical houses.

Bone Healing

Bone recuperation is a complicated physiological method [9]. The placing function of bone recuperation, as in comparison to recuperation in different tissues, is that restore is via way of means of the authentic tissue, now no longer scar tissue. Regeneration is possibly a higher descriptor than restore. This is related to the potential for reworking that intact bone possesses. Like different types of recuperation, the restore of bone fracture consists of the tactics of infection, restore, and transforming; however, the sort of recuperation varies relying at the approach of remedy. According to Wolff law, bone remodels alongside strains of pressure. Bone is continuously being resorbed and changed because the resorption of circumferential lamellar bone is done via way of means of osteoclasts, and changed with dense osteonal bone via way of means of osteoblasts. In traditional histological terms, fracture recuperation has been divided into broad phases: number one fracture recuperation and secondary fracture recuperation.

- Primary recuperation, or number one cortical recuperation, includes an immediate try via way of means of the cortex to reestablish itself as soon as it has emerge as interrupted. In number one cortical recuperation, bone on one facet of the cortex have to unite with bone at the different facet of the cortex to reestablish mechanical continuity.
- Secondary recuperation includes responses within the periosteum and outside smooth tissues with the following formation of a callus. The majority of fractures heal via way of means of secondary fracture recuperation.

Within those broader phases, the method of bone recuperation includes a aggregate of intramembranous and endochondral ossification. These tactics participate within the fracture restore collection via way of means of as a minimum 4 discrete ranges of recuperation: the hematoma formation (infection or

granulation) phase, the smooth callus formation (proliferative) phase, the tough callus formation (maturing or modeling) phase, and the transforming phase.

New Technologies

New technology have provided the orthopedic physician with numerous alternatives to be had for surgical operation with using AICS (antibiotic impregnated cement spacers) [10]. The blessings of static or easy spacers formed within the working room encompass: a easy assemble which is straightforward for the physician to make, the physician is capable of choose the antibiotic of preference directed with organism precise remedy. This easy/static spacer can be beneficial for a couple of I&D approaches and to permit transport of a couple of antibiotics from one spacer. The downside of a static/non-cellular spacer is that it does now no longer permit physiologic movement of the joint, that is of secondary significance throughout contamination remedy. In addition, the problem of cement generated exothermic warmness, cement shrinkage, and publicity to monomer can be of concern. Similarly, there are headaches which can arise with static antibiotic spacers. The blessings of cellular cement spacers that are preformed encompass the choice of permitting an detail of physiologic joint movement. These spacers generally tend to be easy, 'off the shelf' gadgets with a set antibiotic (and presently unmarried antibiotic) dose. There is proof that cellular articulating spacers can also additionally lessen bone loss in affiliation with a 2d degree reimplantation surgical operation. There is no warmness or shrinkage which can arise with those preformed implants. The strengthened important middle of this sort of implant can also additionally offer huge biomechanical blessings towards catastrophic failure or fracture of the implant. The hazards of cellular spacers that are preformed protected a trouble in implant sizes and antibiotic dose, regularly permitting best a single agent transport of antibiotic. The spacers have little to no inherit constraint and there may be a restricted range of alternatives for offset healing with the hip implants. The cellular spacer that is preformed additionally can be situation to headaches with its use.

Conclusion

Implantation of an artificial hip is one of the most common and successful operations in modern orthopedics. Modern endoprosthesis manufacturing technology, high-quality biomaterials and advanced operative technique enable quick postoperative recovery and complete disappearance of pain present before surgery. Among the most common reasons for installing a total hip endoprosthesis are arthrosis, rheumatic diseases, avascular necrosis of the femoral head, femoral neck fracture and the consequences of such a fracture. Total hip endoprostheses are divided into cementless and cemented. Cementless endoprostheses,

thanks to a special production technology, imitate the surface of the bone, which enables bone to grow into the endoprosthesis. With cement endoprostheses, a special medical cement is used to fill the space between the bone and the surface of the endoprosthesis. Cementless endoprostheses are implanted in younger patients with good bone quality that will grow into the endoprosthesis and achieve strength. It should be emphasized that both cementless and cemented hip endoprostheses are of equal quality and durability.

References

1. Evans BG, Zawadsky MW (2010) The Hip and Femur. In: Wiesel, SW, Delahay, JN (Eds.), *Essentials of Orthopedic Surgery*, Fourth Edition, Springer Science+Business Media, New York, USA, pp. 401-430.
2. Göktaş H, Subaşı E, Uzkut, M, Kara M, Biçici H, et al. (2022) Optimization of Hip Implant Designs Based on Its Mechanical Behaviour In: Hadamus, A Piszczatowski S, Syczewska M, Błażkiewicz M (Eds.), *Biomechanics in Medicine, Sport and Biology*, Springer Nature Switzerland AG, Cham, Switzerland, p. 37-38.
3. Pereira G, Paschos NK, Kelly IV JD (2019) Pelvis and Hip In: Paschos NK, Bentley G (Eds.), *General Orthopaedics and Basic Science*, Springer Nature Switzerland AG, Cham, Switzerland, p. 9.
4. Sculco TP, Lombardi P (2006) Hip Pain In: Paget SA, Gibofsky A, Beary III JF, Sculco TP, Erkan D, Smolen JS, Bombardieri S (Eds.), *Hospital for Special Surgery Manual of Rheumatology and Outpatient Orthopedic Disorders - Diagnosis and Therapy*, Lippincott Williams & Wilkins, Wolters Kluwer, Philadelphia, USA, pp. 164.
5. Bains PS, Singh G, Bhui AS, Sidhu SS (2019) Parametric Evaluation of Medical Grade Titanium Alloy in MWCNTs Mixed Dielectric Using Graphite Electrode. In: Bains PS, Sidhu SS, Bahraminasab M, Prakash C (Eds.), *Biomaterials in Orthopaedics and Bone Regeneration - Design and Synthesis*, Springer Nature Singapore Pte Ltd., Singapore, Singapore, p. 1-2.
6. Hamdi A, Beaulé PE (2012) Minimally Invasive Techniques in Total Hip Arthroplasty. In: Bhandari, M. (Edt.), *Evidence-based Orthopedics*, Blackwell Publishing Ltd, John Wiley & Sons, Ltd, Chichester, UK, pp. 164.
7. Willey MC, Bui GA, Marsh JL (2020) Periarticular Fractures. In: Crist BD, Borelli jr J, Harvey EJ (Eds.), *Essential Biomechanics for Orthopedic Trauma - A Case-Based Guide*, Springer Nature Switzerland AG, Cham, Switzerland, p. 79-80.
8. Celik E, Alemdar F, Bati M, Dasdemir MF, Buyukbayraktar OA Chethan, et al. (2022) Mechanical Investigation for the Use of Polylactic Acid in Total Hip Arthroplasty Using FEM Analysis. In: Hadamus, A.; Piszczatowski, S.; Syczewska, M.; Błażkiewicz, M. (Eds.), *Biomechanics in Medicine, Sport and Biology*, Springer Nature Switzerland AG, Cham, Switzerland, p. 17-18.
9. Dutton M (2011) *Dutton's Orthopedic Survival Guide - Managing Common Conditions*, The McGraw-Hill Companies, Inc., New York, USA, p. 32.
10. Burnett RSJ, Clohisy JC, Barrack RL (2007) Antibiotic Cement Spacers in Total Hip and Total Knee Arthroplasty: Problems, Pitfalls, and Avoiding Complications. In: Meani, E.; Romanò, C; Crosby L, Hofmann G (Eds.), *Infection and Local Treatment in Orthopedic Surgery*, Springer-Verlag Berlin Heidelberg, Berlin, Germany, p. 95.

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