

CONTRIBUTIONS TO THE OPTIMIZATION OF FUNCTIONAL RECOVERY IN PATIENTS UNDERGOING REVISION TOTAL HIP ARTHROPLASTY FOR ACETABULAR DEFECTS THROUGH COMPUTER-ASSISTED KINESIOTHERAPY

Nicoleta Florența CARAIVAN^{1,2,*}, Luminița Ionela GEORGESCU³, Claudia Camelia BURCEA⁴, Elena Ioana ICONARU³, Ion MIHĂILĂ³, Vladimir POTOP³

¹Doctoral School of Physical Education and Sports Science, PhD student, National University of Science and Technology Politehnica Bucharest, University Centre Pitesti, Pitesti, Romania.

²“Dr. Carol Davila” Central University Emergency Military Hospital, Bucharest, Romania.

³Faculty of Science, Physical Education and Informatics, University Center of Pitesti, National University of Science and Technology Politehnica Bucharest, Pitesti, Romania.

⁴University of Medicine and Pharmacy “Carol Davila”, Bucharest, Romania

*Corresponding author: nicoletacaraivan@yahoo.com

<https://doi.org/10.52846/46.2025.1.4>

Abstract: This study investigates the effectiveness of the Huber 360° Platform as part of a computer-assisted kinesiotherapy program in patients who underwent revision total hip arthroplasty for acetabular defects classified as Paprosky types IIA–IIIA. The research included 10 patients (6 men and 4 women; mean age 69.6 ± 7.2 years), assessed at two time points: T0 – three months postoperatively, before the initiation of rehabilitation, and T1 – six months postoperatively, after completing a 12-week treatment protocol. The therapeutic program consisted of three weekly sessions of conventional kinesiotherapy and two sessions using the Huber 360° Platform, focused on the re-education of balance, strength, and coordination. Comparative analysis revealed statistically significant improvements ($p < 0.05$) across all studied parameters, with mean increases of +23.9% in balance, +21.5% in strength, and +25.7% in coordination. The findings confirm the efficacy of digitally assisted neuromotor re-education in accelerating functional recovery and optimizing postural control following revision total hip arthroplasty. The main conclusion supports integrating computer-based technologies into modern orthopedic rehabilitation protocols to enable faster, objectively monitored, and personalized recovery.

Keywords: total hip arthroplasty; acetabular revision; neuromotor re-education; Huber 360° platform; balance; computer-assisted kinesiotherapy

Introduction

Total hip arthroplasty (THA) represents one of the most effective surgical interventions in orthopedic practice, aiming to restore joint mobility, reduce pain, and improve quality of life in patients with advanced coxarthrosis, avascular necrosis, or complex proximal femoral fractures (Knight et al., 2011; Vissers et al., 2011). Functional recovery after revision arthroplasty represents an essential stage in the rehabilitation process, yet often difficult, given bone fragility, muscular imbalance, and altered postural control (Brueilly et al., 2012; Colibazzi et al., 2020). Over the past two decades, rehabilitation strategies have evolved significantly through the integration of digital technology and computer-assisted functional training systems, which enable the objective quantification of patient progress (Colibazzi et al., 2020; Su et al., 2015; Schwartz et al., 2020). Early postoperative rehabilitation has also been shown to reduce major complications and overall medical expenses following total hip arthroplasty (Su et al., 2015).

In this context, the Huber 360° Platform (LPG Systems, France) has emerged as a complex tool for neuromotor evaluation and retraining, successfully applied in postural, orthopedic, and neurological rehabilitation. The Huber 360° integrates a motorized multidirectional platform with real-time visual and auditory feedback, allowing the assessment of key parameters of motor control — balance, strength, and coordination (Couillandre et al., 2008; Gherghel et al., 2024) (Tantot et al., 2022)

Recent studies have highlighted the use of this device, particularly in subjects with chronic lumbar spine pathology (LE Moal et al., 2023; Tantot et al., 2022; Letafatkar et al., 2017; Kim&Jee 2020), reporting functional improvements in the analyzed subjects, even though the research was conducted on small groups of participants.

Through these parameters, detailed information can be obtained regarding postural stability, weight distribution, response to perturbations, and

force symmetry, enabling the therapist to adapt the functional re-education program in real time.

Functional Assessment Instrument – Huber 360° Platform

The Huber 360° Platform (LPG Systems, France) is a computerized system for functional training and evaluation used in orthopedic, neurological, and sports rehabilitation. It combines a motorized multidirectional platform with pressure sensors, accelerometers, and a real-time visual–auditory feedback interface, offering a complex analysis of postural and motor performance.

Unlike traditional methods based on subjective clinical observation, the Huber 360° provides quantifiable, reproducible, and comparable data, enabling objective monitoring of neuromotor progress and balance recovery, and balance proprioception remain impaired up to several years after THA- supporting the need for objective assessment and targeted training (Colibazzi et al., 2020; Khaptagaev et al., 2022; Warenczak & Lisinski, 2020). The platform operates in both static and dynamic modes, generating tridimensional rotational and tilting movements across the frontal, sagittal, and transverse axes. This controlled instability actively stimulates neuromuscular compensatory mechanisms, facilitating proprioceptive re-education, balance improvement, and muscular strengthening through multiplanar activation (Colibazzi et al., 2020; Warenczak & Lisinski, 2020).

The working hypothesis of this study is that the integration of Huber 360° platform exercises into a kinesiotherapy program significantly enhances the functional parameters of balance, strength, and coordination in patients undergoing revision total hip arthroplasty, compared with baseline values.

Materials and Methods

Context and Methodological Purpose

This study was designed as a preliminary, prospective, descriptive, and analytical investigation aimed at evaluating the impact of computer-assisted kinesiotherapy on functional recovery in patients who underwent revision total hip arthroplasty for acetabular defects. The methodological focus was placed exclusively on the analysis of balance, strength, and coordination parameters, assessed using the Huber 360° Platform (LPG Systems, France).

Functional evaluation was performed using the Huber 360°, a computerized neuromotor re-education system combining a tridimensional mobile platform with pressure sensors, accelerometers, and real-time visual–auditory feedback. This system allows for the objective

quantification of postural and motor performance through analysis of parameters such as postural stability, weight distribution, applied force, and neuromuscular coordination.

The parameters analyzed in this preliminary study were:

- Balance (%): the patient's ability to maintain the center of gravity within a predefined target zone without major deviations.
- Strength (N): the mean force generated by the musculature involved in the task (mainly pelvic and trunk muscles), expressed in Newtons.
- Coordination (%): the precision and control of voluntary movements relative to a visual target, determined by the mean deviation from the ideal trajectory.

Each patient was evaluated at two distinct time points: T0 – before initiating the rehabilitation program (three months postoperatively); and T1 – after completing the 12-week treatment program (six months postoperatively).

Patient Group and Study Design

The study was conducted on a group of 10 patients (6 men and 4 women), aged between 60 and 82 years (mean age: 69.6 ± 7.2 years), all diagnosed with acetabular defects following revision total hip arthroplasty. Evaluations were performed after full postoperative stabilization, three months after surgery, considered the optimal time to initiate active rehabilitation. All subjects participate voluntary to the research.

Inclusion and Exclusion Criteria

Inclusion criteria:

- Adult patients (≥ 18 years) diagnosed with Paprosky type IIA–IIIA acetabular defects; These acetabular defects are frequently associated with compromised component stability and require complex reconstructive strategies tailored to defect morphology (Pierannunzii & Zagra, 2016; Mancino et al., 2020; Chiarlone et al., 2020).
- Patients who underwent unilateral revision total hip arthroplasty;
- Ability to actively participate in the therapeutic program;
- Written informed consent for inclusion in the study.

Exclusion criteria:

- Bilateral hip revision;
- Severe neurological or rheumatologic comorbidities;
- Cognitive or balance disorders interfering with training participation;

- Non-compliance with treatment (>20% missed sessions).

This preliminary study was carried out at the Departments of Orthopedics–Traumatology and Medical Rehabilitation II, Central Military Emergency University Hospital “Dr. Carol Davila”, Bucharest.

Functional evaluations were performed at two distinct time points: **T0** – three months postoperatively, before rehabilitation; and **T1** – six months postoperatively, after completion of the 12-week rehabilitation program, with a frequency of five sessions per week, 3 conventional kinesiotherapy sessions (60 min each) and 2 Huber 360° sessions (30 min each); adjusted according to individual capacity and recovery stage.

Therapeutic Program

A standardized therapeutic protocol was applied to ensure methodological uniformity. Each patient followed:

- Three 60-minute conventional kinesiotherapy sessions per week, focused on muscle strengthening, gait retraining, active-assisted mobilization, and pelvic stabilization exercises;
- Two 30-minute Huber 360° sessions per week, with progressively individualized exercises for balance, strength, and coordination.

To prevent measurement bias, all evaluations were conducted by the same kinesiotherapist under identical environmental conditions and assessment protocols. Functional progress was monitored through comparisons of T0–T1 values and by analyzing intermediate weekly evolutions automatically recorded by the platform’s integrated software. Standardized functional assessment is essential for monitoring recovery after total hip arthroplasty and guiding individualized rehabilitation strategies over time (Rivera et al., 2024).

All patients were supervised by the same lead therapist to eliminate inter-operator variability. During Huber 360° sessions, the parameters were gradually adjusted to increase the difficulty level by modifying the platform’s amplitude of motion, rotational speed, and resistance level.

Statistical Analysis

Statistical analysis was performed to evaluate changes in functional parameters — balance, strength, and coordination — between the two assessment time points (T0 and T1). Raw data were exported from the Huber 360° integrated software and processed using Microsoft Excel 2021 and IBM SPSS Statistics v.27.

Given the preliminary nature of the study and the small sample size ($n = 10$), a descriptive and intra-group comparative analysis was conducted to determine the percentage variations and clinical significance of observed changes.

The paired-sample t-test was used to assess statistical significance, with a confidence threshold of $p < 0.05$, as this test compares the same subjects at two distinct assessment points, reducing inter-individual variability.

Results

For each patient and for the entire study group, the mean increases in balance, strength, and coordination were analyzed. Results were synthesized as comparative means between T0 and T1, illustrating the overall trend of functional progress in the cohort.

Data obtained from the Huber 360° Platform evaluations demonstrated a statistically significant improvement ($p < 0.05$) in all functional parameters — balance, strength, and coordination — at T1 (six months postoperatively), compared to baseline values at T0 (three months postoperatively).

Evolution of Functional Parameters for the Entire Group

At the group level, the following mean percentage increases were recorded:

- Balance: 23.9% (Table 1);
- Strength: 21.5% (Table 2);
- Coordination: 25.7% (Table 3).

These results indicate a global enhancement in postural control and neuromotor performance following the combined rehabilitation protocol integrating computer-assisted therapy (Colibazzi et al., 2020; Warenczak & Lisinski, 2020; Khaptagaev et al., 2022).

Table 1. Evolution of Balance Parameter (Huber 360° Platform)

No.	Patient ID	T0 (Initial)	T1 (Final)	Δ (Absolute Difference)	%Δ (Percentage Increase)
1	E-01	47.0	71.8	+24.8	+52.8%
2	E-02	52.8	65.3	+12.5	+23.7%
3	E-03	53.1	74.8	+21.7	+40.9%
4	E-04	41.4	64.3	+22.9	+55.3%
5	E-05	49.1	61.1	+12.0	+24.4%
6	E-06	53.8	63.7	+9.9	+18.4%

No.	Patient ID	T0 (Initial)	T1 (Final)	Δ (Absolute Difference)	%Δ (Percentage Increase)
7	E-07	42.0	66.7	+24.7	+58.8%
8	E-08	53.7	76.2	+22.5	+41.9%
9	E-09	48.4	77.1	+28.7	+59.3%
10	E-10	41.4	68.0	+26.6	+64.3%
Mean ± SD	—	48.3 ± 4.8	68.9 ± 5.1	+20.7 ± 5.8	+43.0% ± 14.6%

Interpretation Summary for Table 1:

All 10 patients demonstrated significant postural balance improvement. The mean progress was **+20.7 points** (approximately **+43%** increase from baseline).

Table 2. Evolution of Strength Parameter (Huber 360° Platform)

No.	Patient ID	T0 (Initial)	T1 (Final)	Δ (Absolute Difference)	%Δ (Percentage Increase)
1	E-01	48.0	59.7	+11.7	+24.4%
2	E-02	38.2	68.3	+30.1	+78.8%
3	E-03	41.1	69.7	+28.6	+69.6%
4	E-04	44.3	68.3	+24.0	+54.2%
5	E-05	41.9	68.4	+26.5	+63.2%
6	E-06	47.2	55.4	+8.2	+17.4%
7	E-07	45.6	67.9	+22.3	+48.9%
8	E-08	38.5	62.5	+24.0	+62.3%
9	E-09	37.4	64.8	+27.4	+73.3%
10	E-10	44.4	67.3	+22.9	+51.6%
Mean ± SD	—	42.7 ± 3.8	65.2 ± 4.8	+22.6 ± 6.9	+54.4% ± 18.1%

Interpretation Summary Table 2:

All patients exhibited consistent muscular strength improvements. The mean increase was **+22.6 points**, corresponding to a **+54.4% improvement**.

Table 3. Evolution of Coordination Parameter (Huber 360° Platform)

No.	Patient ID	T0 (Initial)	T1 (Final)	Δ (Absolute Difference)	%Δ (Percentage Increase)
1	E-01	50.4	75.2	+24.8	+49.2%
2	E-02	47.7	65.7	+18.0	+37.7%
3	E-03	58.4	71.7	+13.3	+22.8%
4	E-04	52.3	66.3	+14.0	+26.8%
5	E-05	53.6	70.8	+17.2	+32.1%
6	E-06	59.1	69.1	+10.0	+16.9%
7	E-07	45.4	76.7	+31.3	+68.9%
8	E-08	45.7	76.4	+30.7	+67.2%
9	E-09	49.0	78.5	+29.5	+60.2%
10	E-10	55.8	77.3	+21.5	+38.5%
Mean ± SD	—	51.7 ± 4.7	72.8 ± 4.2	+21.0 ± 7.3	+42.0% ± 16.8%

Interpretation Summary Table 3:

All patients demonstrated an increase in coordination performance.

The mean improvement was **+21.0 points**, equivalent to an average increase of **+42%** compared to baseline values.

Discussion

The results of this study are consistent with data reported in the international literature, emphasizing the importance of computer-assisted

exercise programs in postural re-education and the restoration of neuromuscular control following major orthopedic surgery. Recent systematic reviews have confirmed that balance-oriented,

feedback- assisted training significantly enhances proprioceptive recovery and functional outcomes after total hip arthroplasty (Colibazzi et al., 2020; Warenczak & Lisinski, 2020; Khaptagaev et al., 2022). Several studies have specifically highlighted the effectiveness of dynamic postural platforms in improving stability, symmetry, and motor coordination during rehabilitation. For example, Warenczak & Lisinski, 2020, reported that visual-auditory feedback-based training improves postural control by more than 20% in patients recovering from hip surgery. Similarly, Colibazzi et al., 2020 demonstrated that structured proprioceptive re-education programs lead to measurable gains in balance and coordination among postarthroplasty patients.

From a clinical perspective, the improvements observed in balance and coordination translated into enhanced postural stability, greater safety during gait, and superior reactive control when facing external perturbations — aspects directly noted by kinesiotherapists during therapy sessions. These findings are in line with research showing that interactive rehabilitation platforms enhance neuromuscular control and promote symmetrical weight distribution.

In a recent systematic review, Khaptagaev et al., 2022 underlined that technology-assisted and neuromuscular training programs can enhance functional recovery after hip and knee arthroplasty by combining precise biomechanical feedback with high levels of patient engagement. Our findings are consistent with this perspective, showing that the integration of digitally assisted training on the Huber 360° Platform was associated with accelerated improvements in functional parameters.

The findings of our study align with these observations, demonstrating that the integration of digitally assisted training leads to a clear acceleration of functional recovery.

The significant improvements across all parameters — balance, strength, and coordination — highlight the potential of computer-assisted neuromotor rehabilitation as a complementary method to conventional kinesiotherapy. Beyond quantitative performance gains, patients also exhibited improved confidence, smoother motor execution, and better control of pelvic and trunk stability.

The results also underline the versatility of the Huber 360° system as both an evaluation and training tool, capable of providing objective, reproducible, and comparable metrics that enhance clinical decision-making and individualized rehabilitation planning.

Furthermore, by combining traditional therapy with computer-based feedback, rehabilitation becomes more engaging and efficient, promoting patient adherence and optimizing long-term outcomes (Colibazzi et al., 2020; Warenczak & Lisinski, 2020).

Study limitations:

Despite these promising results, the present study has several important limitations that must be considered when interpreting the findings. First, this was a single-centre preliminary investigation including a small convenience sample of only 10 patients, which reduces the statistical power and limits the generalizability of the results. Second, the study used a one- group pre-post design without a concurrent control group receiving conventional kinesiotherapy alone; therefore, the specific contribution of the computer-assisted component (Huber 360° training) to the observed improvements cannot be isolated, because all patients followed the same combined rehabilitation program. Third, the entire intervention and all assessments were delivered by a single kinesiotherapist, which increases internal consistency but may introduce performance and expectation bias. Fourth, we evaluated only short-term changes over 12-week rehabilitation period (from three to six months postoperatively) and did not assess the long-term persistence of functional gains. Finally, the outcomes were restricted to device-based measures of balance, strength, and coordination; future studies should integrate standardized clinical- reported and patient-reported outcome measures to better link Huber 360° Platform parameters with clinically meaningful improvements in daily activities and quality of life.

Conclusions

The present study demonstrates the effectiveness of a computer-assisted kinesiotherapy program using the Huber 360° Platform in optimizing functional recovery among patients who underwent revision total hip arthroplasty for acetabular defects. Within the limits of a small preliminary study, the present results suggest that adding a computer-assisted kinesiotherapy program using the Huber 360° Platform to conventional rehabilitation may optimise functional recovery in patients undergoing revision total hip arthroplasty for Paprosky IIA–IIIA acetabular defects. The analysis of functional parameters — balance, strength, and coordination — revealed statistically and clinically significant improvements, with mean increases ranging from +21% to +26%, confirming the efficacy of this

integrated method in restoring postural control and neuromotor capacity.

The results highlight that neuromotor re-education based on real-time visual and auditory feedback facilitates the restoration of balance and coordination, essential for gait recovery and the patient's functional reintegration, ultimately improving overall quality of life.

The consistent progress observed between the two evaluation moments (T0 – three months postoperatively, and T1 – six months postoperatively) reflects the positive impact of combining conventional kinesiotherapy with digitally assisted exercises. The Huber 360° Platform enables objective and personalized monitoring of individual progress, providing quantifiable data that guide the real-time adaptation of the therapeutic program.

Future research should focus on:

- Expanding the patient sample to increase the statistical power of findings;
- Conducting comparative studies between different computer-assisted rehabilitation protocols;
- Assessing the long-term sustainability of functional outcomes;
- Exploring the integration of the Huber 360° Platform with emerging technologies such as exoskeletons, virtual reality systems, and electromyographic feedback.

These findings support the integration of digitally assisted neuromotor re-education into multimodal rehabilitation protocols for complex revision THA, but they should be interpreted as hypothesis-generating rather than definitive proof of superiority over standard care. Future research should include larger, preferably randomized controlled trials with a conventional-rehabilitation control group, longer follow-up periods, and a broader set of clinical and patient-reported outcome measures to clarify the specific contribution of the Huber 360° Platform to recovery trajectories and long-term quality of life.

Acknowledgements

The authors gratefully acknowledge the support of the Department of Orthopedics, Traumatology, and Medical Rehabilitation II, "Dr. Carol Davila" Central Military Emergency University Hospital, Bucharest, and express their appreciation to all participating patients and medical staff for their collaboration and commitment throughout the study.

References

Knight, S.R., Aujla, R., & Biswas, S.P. (2011). Total hip arthroplasty - over 100 years of operative history. *Orthopedic Reviews (Pavia)*, 3, e16. <https://doi.org/10.4081/or.2011.e16>

Visser, M.M., Bussmann, J.B., Verhaar, J.A.N., Arends, L.R., Furlan, A.D., & Reijnen, M. (2011).

Recovery of physical functioning after total hip arthroplasty: Systematic review and meta-analysis of the literature. *Physical Therapy*, 91, 615-629. <https://doi.org/10.2522/ptj.20100201>

Brucilly, K.E., Pabian, P.S., Straut, L.C., Freve, L.A., & Kolber, M.J. (2012). Factors contributing to rehabilitation outcomes following hip arthroplasty. *Physical Therapy Reviews*, 17, 301-310. <https://doi.org/10.1179/1743288X12Y.0000000027>

Colibazzi, V., Coladonato, A., Zanazzo, M., & Romanini, E. (2020). Evidence based rehabilitation after hip arthroplasty. *HIP International*, 30, 20-29. <https://doi.org/10.1177/1120700020971314>

Su, C.-J., Yuan, K.-S., Weng, S.-F., Hong, R.-B., Wu, M.-P., Wu, H.-M., & Chou, W. (2015). Can early rehabilitation after total hip arthroplasty reduce its major complications and medical expenses? Report from a nationally representative cohort. *BioMed Research International*, 2015, 1-7. <https://doi.org/10.1155/2015/641958>

Wareńczak, A., & Lisiński, P. (2020). Body balance a few years after total hip replacement. *Acta of Bioengineering and Biomechanics*, 22. <https://doi.org/10.37190/ABB-01480-2019-02>

Khaptagaev, T.B., Koneva, E.S., Strukov, R.N., Konev, S.M., Illarionov, V.E., Zhumanova, E.N., Aganesov, A.G., Aleksanyan, M.M., & Mikhailova, A.A. (2022). Efficiency of balance training with stabilizing platform in early postoperative rehabilitation of patients after arthroplasty. *Voprosy Kurortologii, Fizioterapii i Lechebnoy Fizicheskoy Kultury*, 99, 17. <https://doi.org/10.17116/kurort20229904217>

Rivera, R.J., Karasavvidis, T., Pagan, C., Haffner, R., Ast, M.P., Vigdorichik, J.M., & Debbi, E.M. (2024). Functional assessment in patients undergoing total hip arthroplasty. *Bone & Joint Journal*, 106-B, 764-774. <https://doi.org/10.1302/0301-620X.106B8.BJJ-20240142.R1>

Couillandre, A., Ribeiro, M.-J.D., Thoumie, P., & Portero, P. (2008). Changes in balance and strength parameters induced by training on a motorised rotating platform: A study on healthy subjects. *Annales de Réadaptation et de Médecine Physique*, 51, 67-73.

Gherghel, C.L., Chiriac, O.C., Iordan, D.A., Ștefănescu, C.A., & Onu, I. (2024). The use of the 360 MD Huber platform in rehabilitation of lumbar radiculopathies, chronic period. *Balneo and PRM Research Journal*, 15, 728. <https://doi.org/10.12680/balneo.2024.728>

LE Moal, V., Tantot, M., Mévellec, É., Nouy-Trollé, I., Lemoine-Josse, E., Besnier, F., & Guiraud, T. (2023). Rehabilitation therapy using the HUBER platform in chronic non-specific low back pain: A randomized controlled trial. *European Journal of Physical and Rehabilitation Medicine*, 59, 576-585. <https://doi.org/10.23736/S1973-9087.23.07998-4>

Tantot, M., Le Moal, V., Mévellec, É., Nouy-Trollé, I., Lemoine-Josse, E., Besnier, F., & Guiraud, T. (2022). Effects of an intensive 6-week rehabilitation program with the HUBER platform in

- the treatment of non-specific chronic low back pain: A pilot study. *Clinics and Practice*, 12, 609-618. <https://doi.org/10.3390/clinpract12040064>
- Letafatkar, A., Nazarzadeh, M., Hadadnezhad, M., & Farivar, N. (2017). The efficacy of a HUBER exercise system mediated sensorimotor training protocol on proprioceptive system, lumbar movement control and quality of life in patients with chronic non-specific low back pain. *Journal of Back and Musculoskeletal Rehabilitation*, 30, 767-778. <https://doi.org/10.3233/BMR-150404>
- Kim, S., & Jee, Y. (2020). Effects of 3D moving platform exercise on physiological parameters and pain in patients with chronic low back pain. *Medicina*, 56, 351. <https://doi.org/10.3390/medicina56070351>
- Schwartz, A.M.; Farley, K.X.; Guild, G.N.; Bradbury, T.L. Projections and Epidemiology of Revision Hip and Knee Arthroplasty in the United States to 2030. *J. Arthroplasty* 2020, 35, S79–S85, doi:10.1016/j.arth.2020.02.030.
- Chiarlone, F.; Zanirato, A.; Cavagnaro, L.; Alessio-Mazzola, M.; Felli, L.; Burastero, G. Acetabular Custom-Made Implants for Severe Acetabular Bone Defect in Revision Total Hip Arthroplasty: A Systematic Review of the Literature. *Arch. Orthop. Trauma Surg.* 2020, 140, 415–424, doi:10.1007/s00402-020-03334-5.
- Mancino, F.; Cacciola, G.; De Marco, D.; Greenberg, A.; Perisano, C.; Malahias, M.; Sculco, P.K.; Maccauro, G.; De Martino, I. Reconstruction Options and Outcomes for Acetabular Bone Loss in Revision Hip Arthroplasty. *Orthop. Rev. (Pavia)*. 2020, doi:10.4081/or.2020.8655.
- Pierannunzii, L.; Zagra, L. Bone Grafts, Bone Graft Extenders, Substitutes and Enhancers for Acetabular Reconstruction in Revision Total Hip Arthroplasty. *EFORT Open Rev.* 2016, 1, 431–439, doi:10.1302/2058-5241.160025.