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Migration of wear debris of polyethylene depends on bone microarchitecture

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Titre	Migration of wear debris of polyethylene depends on bone microarchitecture
Type de publication	Article de revue
Auteur	Marchand-Libouban, Hélène [1], Massin, Philippe [2], Gaudin, Christine [3], Mercier, Philippe [4], Baslé, Michel-Félix [5], Chappard, Daniel [6]
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Année	2009
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Mots-clés	bone architecture [7], MicroCT [8], photopolymerization [9], polyethylene [10], wear debris [11]
Résumé en anglais	The mechanism of hip arthroplasties loosening is related to the migration of wear debris throughout the implant environment. In vivo, polyethylene particles (PE) were shown to infiltrate the bone implant interface and the medullary spaces of the cancellous bone. Our test hypothesis was that polyethylene particle migration is correlated to bone porosity. Bone samples with a high or low trabecular volume and microarchitecture were harvested in 20 calves and 20 human cadavers. They were extensively washed to remove marrow cells. Bone cylinders were filled with a light-curing monomer having the same viscosity as bone marrow. PE particles (7 and 33 μm) were deposited at the surface of the polymer. The bone cylinders were agitated during 7 days on an orbital shaker and the gel was left to polymerize at day light. X-ray microtomography was performed to characterize bone volume and microarchitecture. Cylinders were sectioned and observed under polarized light. The migration distance and rate were determined. Migration of PE particles strongly depended on trabecular bone volume and microarchitecture. We found a linear relationship (r = 0.61) between speed migration and bone volume and an exponential relationship between speed migration and bone architecture. The present in vitro model confirmed our hypothesis about the key role of bone microarchitecture in the migration of large PE wear particles. This is an explanation for the development of inflammatory reaction at distance from a prosthesis although our study did not include submicron particles.
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