Reviewer's report

Title: Microstructure and biomechanical characteristics of bone substitutes for trauma and orthopaedic surgery

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Reviewer: Louis Cheung

Reviewer's report:

This is a study attempting to directly compare the structural and biomechanical properties of nine bone substitute cements registered for orthopaedic trauma surgery in the Netherlands under the same settings. The authors established a strict sample setup at 2:1 ratio of length and diameter for testing. MicroCT scanning was performed to evaluate the porosity, pore size, connectivity and SMI. Biomechanical testing involves the measurement of compression strength and Young’s modulus. This is a purely observational study; despite not hypothesis-driven approach, this study provides very useful data on different bone substitutes in market. The currently available information are mostly based on the data provided by the manufacturers. An objective and comprehensive comparison of these bone substitutes under the same settings is lacking indeed. The findings of this study will be a very good reference for orthopaedic surgeons to select for different clinical indications.

The present study is straightforward and uses suitable methodologies. There are no major problems. However, I notice two problems that need authors to clarify.

Minor Essential Revisions:

(1) The manuscript mentions three times the importance of ‘biological’ and ‘biomechanical’ characteristics of these bone substitutes in determining their applications and success rate. It sounds as if this study focused on these two aspects. However, this study does not provide ‘biological’ data indeed. To be more precise, this study was working on ‘structural’ and ‘biomechanical’ areas. I think this is one limitation of this study not including biological tests (also echo my second comment) but I understand this is rather difficult.

(2) This is good to test the bone substitutes under the same settings in vitro. However, I am afraid in vitro conditions may not be exactly equivalent to in vivo ones. For example, OSTIM is known to be not hardening in vivo, that is a paste-like material with nanoscopic apatite particles in aqueous dispersion. I am not sure if the in vitro data of OSTIM will be valid as a reference, if applied in vivo. This is another limitation that the authors need to specify or discuss clearly.

Level of interest: An article of importance in its field

Quality of written English: Acceptable
**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**

I declare that I have no competing interests.