An International Web-based Survey To Assess The Consensus Between Surgeons And Scientists On The Development Of Biomaterials For Bone Defects

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Disclosures: Dietmar W. Hutmacher is a cofounder and shareholder of BellaSeno GmbH and Osteopore both being medical technology companies. The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as potential conflicts of interest.

INTRODUCTION: The treatment of bone defects continues to be a major challenge for patients, surgeons and scientists. A variety of treatment options, including autologous bone grafts, bone graft substitutes and 3D-printed implants (bone scaffolds) are increasingly used to facilitate bone regeneration. For effective and cost-efficient biomaterial and implant development, it is crucial to understand the decision-making processes of surgeons and scientists regarding current options and future possibilities for the treatment of bone defects. The question for this study is therefore whether the perceived reality of bone defect care, which is crucial for developing effective care strategies and driving implant development, is the same for surgeons and scientists?

METHODS: An anonymous international website-based survey (Queensland University of Technology Ethics No. LR 2022-6352-11321) of surgeons and scientists was conducted between 22/10/2022 and 13/03/2023. Data were collected electronically in Qualtrics software. Statistical analyses were performed using STATA/MP version 17 (StataCorp), with statistical differences between scientists and surgeons assessed using Student's t-test. A Pearson chi-square test (χ^2-test) was used to compare categorical variables. A significance level of $p < 0.05$ was chosen. The data are presented in the figures as mean value with SD (±) or in figures with mean value and 95% confidence interval (error bars).

RESULTS SECTION: Scientists (n = 99) compared to surgeons (n = 337) both had extensive experience with the treatment of bone defects (9.1 ± 8.3 years and 15.1 ± 10.6 years, respectively; $p < 0.001$) and with biomaterials (12.1 ± 10.2 years and 11.5 ± 10.6 years, respectively; $p = 0.637$). Scientists were significantly more frequently of the opinion that autologous bone grafts will be replaced by synthetic bone substitute products in the future (66.1 ± 25.3 % and 49.2 ± 29.9 %, respectively; $p < 0.001$) and that their development and clinical trials are promising (65.0 ± 22.5 % and 51.1 ± 25.9 %, respectively; $p < 0.001$; Figure 1). Regarding 3D-printed bone scaffolds for the treatment of bone defects, scientists were more frequently convinced that more large-animal studies (63.9 ± 28.5 % and 53.3 ± 30.2 %, respectively; $p = 0.011$) and more clarity on legal and regulatory issues were needed (76.79 ± 26.5 % and 68.9 ± 29.4 %, respectively; $p = 0.049$), while both were in agreement that more clinical trials are needed (70.7 ± 29.3 % and 71.3 ± 27.1 %, respectively; $p = 0.866$; Figure 2).

DISCUSSION: The decision-making processes and competitive understanding in the emerging industry for bone graft substitutes and 3D-printed (biodegradable) biomaterials for the treatment of bone defects differ greatly between surgeons and scientists. Consensus building, e.g. in the context of an interdisciplinary (international) consensus meeting, seems to be urgently needed to enable a cost-efficient development of clinically relevant products for the treatment of bone defects in the medium and long term.

SIGNIFICANCE/CLINICAL RELEVANCE: This study pioneers the evaluation of decision-making for biomaterials relevant to the treatment of bone defects.

IMAGES:

Figure 1. Evaluation of bone graft substitutes and autologous bone grafts. ** $p < 0.001$.

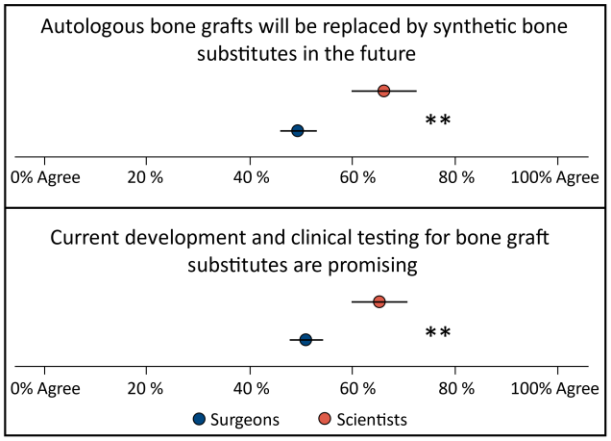

Figure 2. Translational gap for 3D-printed scaffolds. * $p < 0.05$