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Modulation of platelet activation and initial cytokine release by alloplastic bone substitute materials
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Objectives: Platelet-derived cytokines play a crucial role in tissue regeneration. In regenerative dental medicine, bone substitute materials (BSM) are widely used. However, initial interactions of BSM and platelets are still unknown. The aim of this study was to evaluate the potential of platelet activation and subsequent initial cytokine release by different commercial alloplastic BSM.
Material and methods: Eight commercial BSM of different origins and chemical compositions (tricalcium phosphate, hydroxyapatite, bioactive glass: SiO2 and mixtures) were incubated with a platelet concentrate (platelet-rich plasma, PRP) of three healthy volunteers at room temperature for 15 min. Platelet count, aggregation, degranulation (activated surface receptor CD62p) and cytokine release (Platelet-derived growth factor, Vascular endothelial growth factor) into the supernatant were quantified. Highly thrombogenic collagen served as a reference.
Results: The investigated PRP samples revealed different activation patterns when incubated with different BSM. In general, SiO2-containing BSM resulted in high platelet activation and cytokine release. In detail, pure bioactive glass promoted platelet activation most significantly, followed by hybrid BSM containing lower ratios of SiO2. Additionally, we found indications of cytokine retention by BSM of large specific surfaces.
Conclusions: Platelet activation as well as consecutive storage and slow release of plateletderived cytokines are desirable attributes of modern BSM. Within the limits of the study, SiO2-containing BSM were identified as promising biomaterials. Further investigations on cytokine adsorption and cytokine release kinetics by the respective BSM have to be conducted.