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Evaluating the fibroblast viability of different bioceramics for bone and skin regeneration

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Introduction/Objectivies

Bioceramics are extensively used in bone tissue engineering, promoting tissue bonding, bone growth, and damage repair. Moreover, some bioceramics enhance the efficacy of skin healing by regulating the activity of various cell types. So, the objective of this study was to characterize and evaluate bioceramic powder samples with regard to their potential use in bone and skin regeneration

Methodology

Figure 1 shows the experimental scheme. The bioceramics groups of 45S5, B2P, BGg-2A, BGg-2B, E1, F1 and G1 were characterized by optical microscopy and Zeta potential and cell viability was evaluated by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay after 1 day of contact of the commercial fibroblasts cell line MRC-5 with the particles (n = 4 replicates/group). The results were expressed as the mean ± standard deviation (SD).

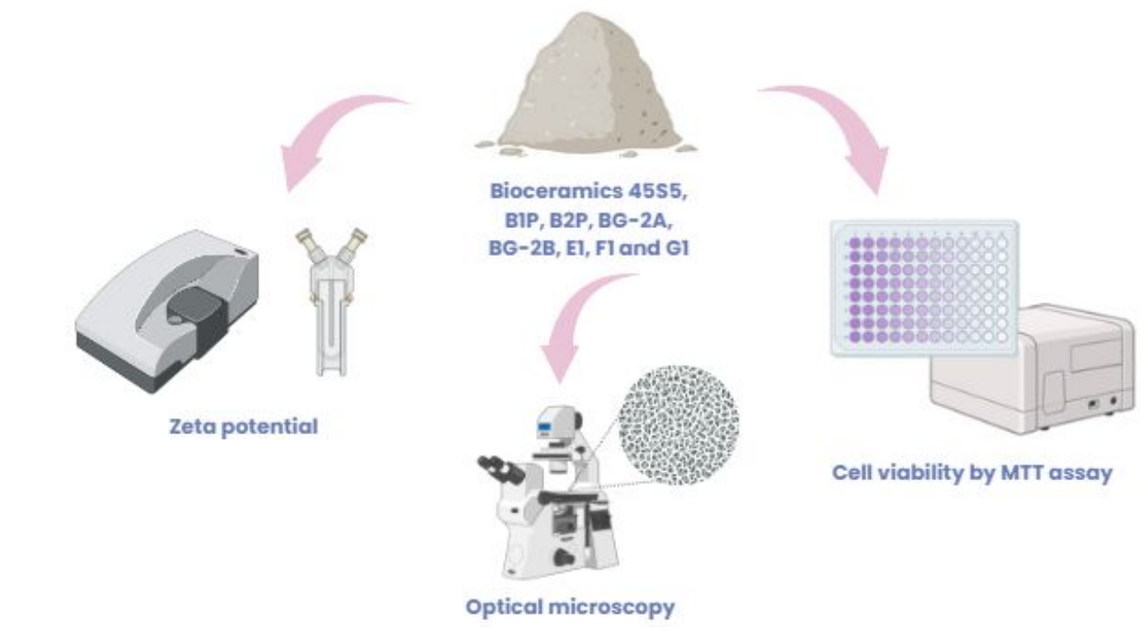

Figure 1. Summary of experiments.

Results

Table 1 details the zeta potential values of the ceramics. The E1 group exhibited the most negative zeta potential value, indicating that it was the most stable sample. In contrast, the B2P, BG-2A, BG-2B, F1, and G1 groups exhibited zeta potential values close to -25 mV, indicating that they exhibited moderate colloidal stability in suspension. Conversely, the B1P and 45S5 groups exhibited the least stable characteristics.

Material	Mean	SD
45S5	-1.69	0.33
B1P	-0.59	0.64
B2P	-26.10	1.11
BGg-2A	-20.33	1.70
BGg-2B	-24.73	1.78
E1	-40.83	2.43
F1	-25.90	3.06
G1	-23.13	2.71

Table 1. Zeta potential distribution of the particles of bioceramics.

Results

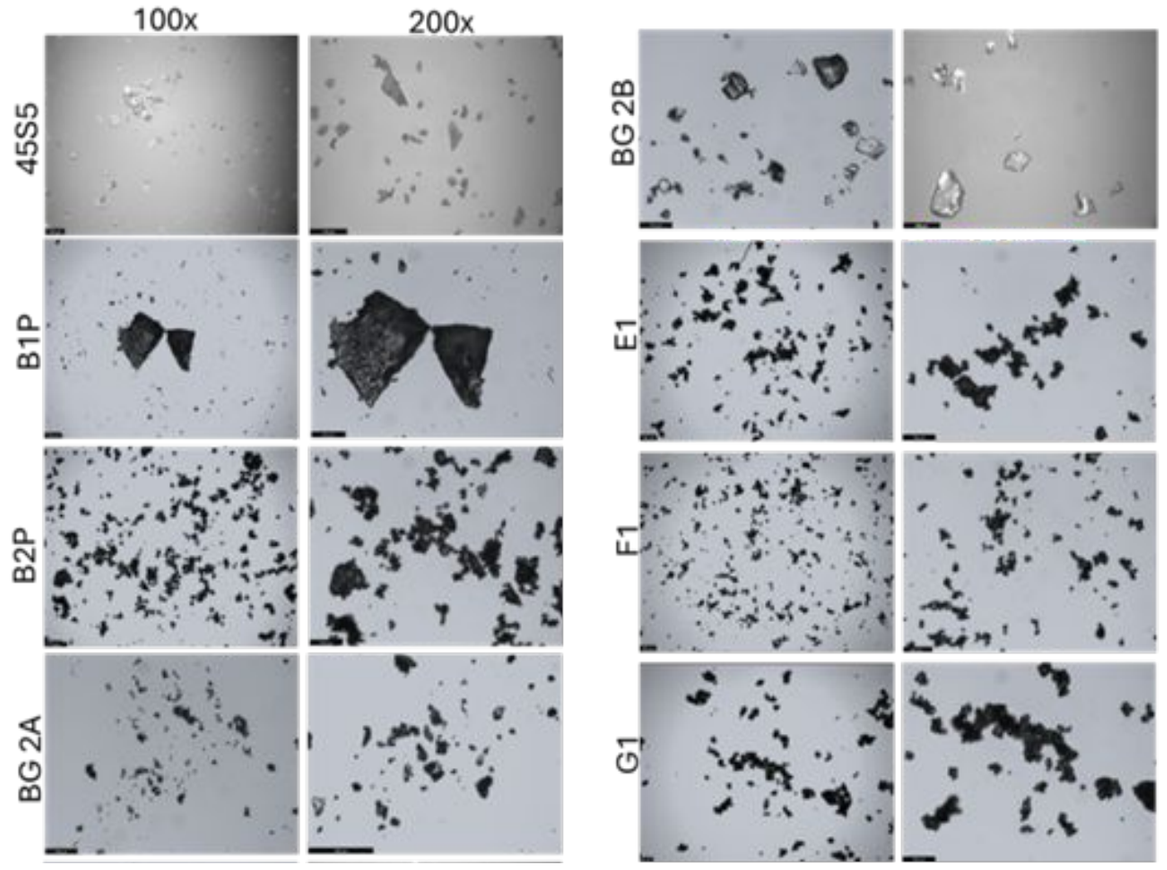

Figure 2. Optical micrographs of particles 45S5, B1P, B2P, 2A, 2B, E1, F1 and G1 at 100 and 200x magnification. The scale bar represents 100 µm.

An optical microscopic analysis reveals that the morphology and size of the different bioceramics samples exhibited irregularities. The commercial 45S5 exhibited fine and pointed particles, whereas the B1P group particles exceeding 100 µM in length (Figure 2).

The MTT assay revealed that there was no significant impact on cell viability after 24 hours. These findings indicate that these new bioceramics possess favorable physicochemical properties and are not cytotoxic (Figure 3).

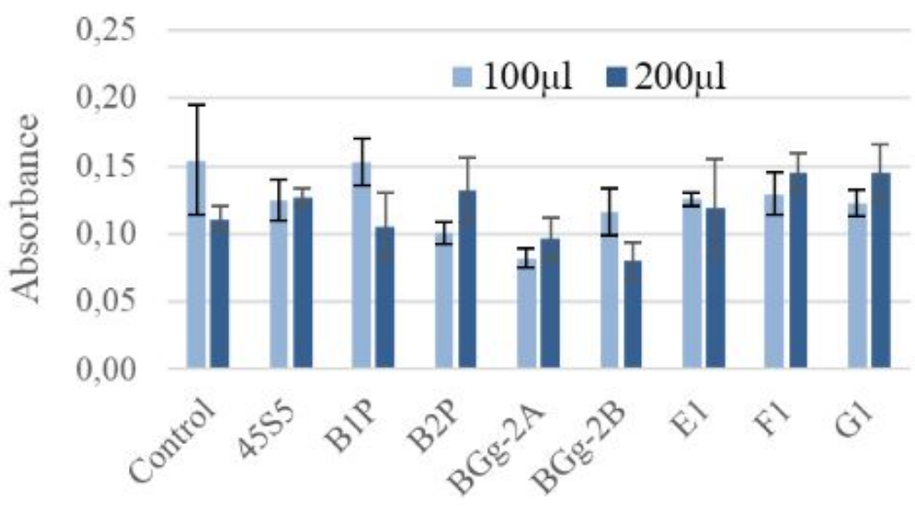

Figure 3. Cell viability determined by MTT in fibroblasts treated with the particles containing 0.5 mg/ml for 1 day. Data expressed as mean ± SD.

Conclusion/Significance

These findings indicate that these new bioceramics possess favorable physicochemical properties and are not cytotoxic. The future prospects include the incorporation of bioceramics in bioinks for bone and skin regeneration.

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