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Research Article

Microstructure And Composition Can Significantly Affect The Properties Of Tissue-Engineered Materials Containing Living Cells

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Opinion

Bioengineering synthetic materials to replace some specific human functions is the inevitable direction of development in the field of materials in the near future. Synthetic materials containing living cells will have a broad application prospect in skin replacement. For example, the market scale of wound repair (avoiding donor site injury, promoting healing, and improving healing quality), such as in vitro validation of beauty products will be 10 billion US dollars. Up to now, in the research of skin substitute materials, many research teams around the world have released a lot of research results, but they still have not fully developed an artificial composite material that can replace human skin. At the same time, they have not developed skin organ products that can solve wound coverage and skin function substitution. Our previous research combined with the research progress of other teams, found the material characteristics of other teams in simulating skin structure, and made improvements. Our research found that GelMA-PEGDA co-network hydrogel to prepare tissue-engineered skin with RRs structure. We have found that 10%GelMA-2%PEGDA hydrogels showed the adequate bioactivity, excellent structural support, suitable degradation rate and high mechanical stability mechanical stability [1]. The advantages of mold one-time forming gelma are low cost, low equipment requirements, low technical requirements, and fast manufacturing speed. It can simulate the net ridge structure between dermis and epidermis, so as to induce the close connection between them; [2].

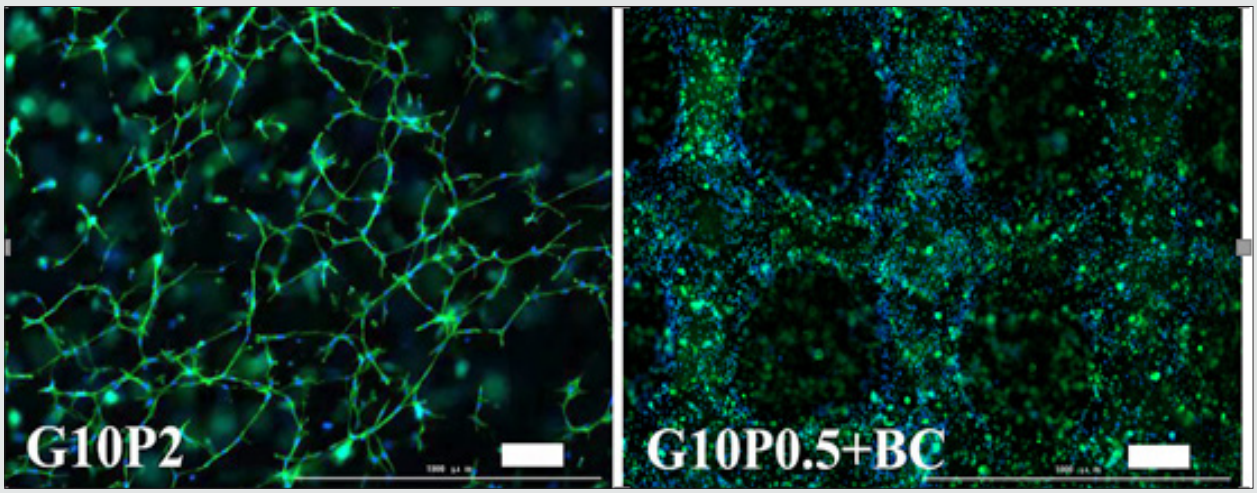

Figure 1. HSFs contained within G10P2 hydrogels and G10P0.5+BC at day 5 stained with DAPI for nuclei (blue) and FITC-phalloidin for F-actin (green). Scale bar: 200 μm.

The disadvantage is that the looseness of the internal structure of the material is completely formed by the cavity after crosslinking and water loss after the material solidification, as shown in Figure 1 and a film layer with few pores will be formed on the material surface due to molecular tension, which may partially lead to unfavorable fluid exchange and cell migration and growth. The current research of our team is based on the deficiencies found in the previous study to further improve the appropriate raw material ratio to make it suitable for biological ink as 3D biological printing. The raw material ratio of biological ink in this study is 10% gelma-0.5% pegda-0.1% BC (BC, bacterial cell). It uses 3D printing technology to maintain the network ridge structure on the material surface, The internal structure of the material is improved by printing and forming, so that the internal structure is also a three-dimensional network structure, which can facilitate the liquid exchange around the cells and the migration and growth of cells in the three-dimensional space [3,4].

The preliminary research results suggest that the expected effect has indeed been achieved. Its in vitro experiment shows that, as shown in the figure, the statistical result of cell proliferation in 3D printing material is about three times higher than that of mold forming material under the same cell inoculation density and culture time. In vivo validation: We conducted in vivo experiments after inoculation of material printing cells. The results showed that the proliferation of two main cells constituting the skin, epidermal cells and fibroblasts, was faster than that of mold forming materials, and the wound healing speed was also faster. The key was that the healing quality could be significantly different at the time point of 2 weeks, The specific results will be introduced in the next treatise. We all know that time is life in clinical rescue. If a material can achieve in vitro proliferation in the shortest time and meet the transplantation requirements, it will greatly increase its practicability for clinical application, and has a very broad prospect in clinical transformation application. The same cell inoculation density has great differences in the proliferation rate of different materials, which shows that the structure, composition, and ratio of materials have a significant impact on the cell proliferation in materials. The two materials currently developed by our team have their own advantages and disadvantages. How to avoid the disadvantages and combine the advantages of the two schemes will be the problem to be solved in the next research.

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