

Hair Beads and Hair Follicle Germs Uses in Regenerative Medicine Preparation

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Editorial

Hair loss is connected to the loss of stem cells necessary for regular hair creation and hair cycle, and can be caused by a variety of factors including heredity, ageing, hormone imbalances, immunological reactions, and anti-cancer treatment therapies. Medications and autologous hair transplantation are the most common treatments for hair loss, but both have drawbacks, such as the limited effects of drugs and the inability to increase the quantity of hairs in the scalp. A series of interactions between epithelium-derived follicular stem cells and mesenchymal-derived follicular stem cells regulate hair follicle production during embryonic development and postnatal hair cycle. Co-transplantation of these stem cells resulted in efficient production of hair follicles and hairs, according to recent research. Hair shafts are formed when follicular epithelial stem cells differentiate [1]. DP cells send signals to follicular epithelial stem cells that control hair shaft size, form, and colour. Both cell types' potential to induce hair growth is gradually reduced after isolation from in vivo tissues and throughout expansion culture. As a result, different techniques to maintaining this ability, including as the use of growth factors and signalling molecules, have been investigated. For example, fibroblast growth factor-2 and bone morphogenetic protein eased the loss of DP cell hair induction ability. Fabricating 3D tissues before to transplantation is another option [2].

When DP cells are cultivated under hanging drop or non-cell adherent culture conditions, they form aggregates and express more DP-specific markers. Recent research has revealed that a compartmentalised hair follicle germ (HFG), created by merging two 3D aggregates of mesenchymal and epithelial cells in vitro, may effectively regenerate hair follicles on the back skin of mice [3]. This is a clever way to mimic embryonic development, but it comes with its own set of challenges. This method entails preparing a significant quantity of HFGs required for human treatment. This is because, in this method, the two aggregates were manually mixed with a pipette under a microscope [4]. We recently published a method for preparing a huge number of HFGs. A mixture of epithelial and mesenchymal cells were planted in a lab-made microwell array plate and allowed to aggregate in microwells in our method. Initially, the two types of cells were randomly distributed in individual aggregates, but they spontaneously and geographically segregated and formed a compartmentalised HFG. This technique proved scalable for the simultaneous creation of > 5000 HFGs since the cells self-organized into segmented HFGs [5].

Given that an epithelial aggregate invaginates into a collagen-rich mesenchymal layer during embryonic development and triggers subsequent morphogenetic changes and hair follicle generation, we hypothesised that a collagen-rich mesenchymal cell aggregate might be a beneficial component of the hair follicle. The next step was to see if HBs could elicit better trichogenous functions in vitro and in vivo than HFGs made with earlier methods. In addition, we looked at whether the HB method might be utilised to mass prepare HFGs using an automated micro-dispenser [6]. The potential of the produced HFGs to develop hairs on the back skin of nude mice was also tested.

This could be a useful germ-like tissue preparation technique for hair regenerative therapy [7]. Under a surgical microscope, embryonic mice were retrieved from a C57BL/6 pregnant mouse and little amounts of their back skin were harvested. Tweezers were used to separate the epithelial and mesenchymal layers after 60 minutes of aseptic treatment with 4.8 U/ml dispase II. The epithelial layer was then treated twice for 40 minutes with 100 U/ml collagenase type I and 0.25 percent trypsin at 37°C. At 37°C, the dermal layer was treated twice with 100 U/ml collagenase type I for 40 minutes. A cell strainer was used to separate debris and undissociated tissues. The epithelial and mesenchymal cells were re-suspended in KG2 and DMEM, respectively, after centrifugation at 1000 rpm for 3 minutes. Without passing aging, the freshly separated cells were employed in studies. We employed a 1:1 mixed culture medium of DMEM and KG2 supplemented with 10% FBS and 1% penicillin-streptomycin when these cells were mixed for co-culture [8].

DPCGM was used to sustain human DP cells, and the medium was replaced every 2–3 days. Experiments were conducted on passage 4 cells. A 1:1 mixture of DPCGM and KG2 culture media was utilised to co-culture DP cells with mouse epithelial cells. On ice, 0.8 ml collagen type I-A, 0.1 ml 10-fold concentrated Ham's F12 medium, and 0.1 ml reconstitution buffer solution were mixed to make a collagen solution. At pH 7, the collagen solution had a concentration of 2.4 mg/ml [9]. The collagen solution was then gently mixed in with mouse mesenchymal cells or human DP cells on ice. The cells were identified as 2-l droplets in the collagen solution. Hair beads and hair follicle germs are prepared in this way. The fabrication of 2-l collagen microgels containing mesenchymal cells can be done manually or automatically. DP stands for dermal papilla cells. The patch assay was used to evaluate the trichogenous activity of HBs formed by the spontaneous constriction of collagen microgels by cell attraction forces. The emergence of Hair creation assays were used to assess trichogenous activity in an HFG made up of an HB and epithelial cell aggregate in a U-shaped microwell [10].

Conflict of Interest

None

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