Abstract Body:

**Background** The loss of perspiration after a massive deep burn hampers the survivor to lead a high life due to deprivation of perspiration function during sultry months. With maturation of science of burn care, the number of survivors is increasing, therefore, the restoration of perspiration function has became a pressing problem for the welfare of survivors.

**Objective** To explore the possibility of transdifferentiating bone marrow mesenchymal stem cells (MSCs) into sweat gland cells (SGCs), and implanting the latter into fresh skin wound to generate functional sweat glands.

**Methods** Human bone marrow MSCs and SGCs were isolated from the same patients. They were identified with specific markers, and then co-cultured. The stem cells which subsequently exhibited the phenotype of SGCs were implanted into scald injured paws of nude mice, and regeneration of functioning sweat glands was confirmed by perspiration test (iodine and starch) and histological examination. A male patient bearing almost identical burn scars on the posterior aspect of both arms was enrolled for clinical trial. The scars were first proved to be anhydrotic with iodine and starch test. With patient’s written consent, the clinical trial was carried out. Bone marrow MSCs and SGCs of the patient were obtained from the patient. After being heat shocked, the SGCs were co-cultured with MSCs Three days later, the scars of both arms were excised. SGCs having acquired the phenotype of SGCs after co-culture were evenly spread onto the excision wound on the right arm. They were covered with a piece of acellular allogeneic dermis, which was perforated with numerous micropores. On top of the latter, micrografts of autologous origin were transplanted, and the wound was finally covered with a piece of allogeneic skin graft. The wound on the left side was similarly covered, but without transdifferentiated MSCs. After complete healing of the wounds, perspiration test with iodine and starch was performed, and biopsy was taken from the MSCs transplanted area. The components of the sweat collected from the implantation area were analyzed and compared with that from normal skin elsewhere on the body. The same procedure was performed in 16 more patients. They were followed-up for 6 to 12 months.

**Results** In the animal experiment, it was shown that there was regeneration of functional sweat glands in the burned paws of the nude mice. In human patients, all wounds healed nicely. The areas where transdifferentiated MSCs were implanted showed positive iodine-starch perspiration test 6 to 12 months after the procedure. Histological and immunohistochemical examination confirmed that the transformed MSCs bore the specific marker carcinoembryonic antigen (CEA) of SGCs. It proved by immunohistochemical method, blood vessels and nerve cells had grown into the neighborhood of the sweat gland structures. Biochemical analysis of the excreted sweat contained similar components as that of sweat collected from normal skin.

**Conclusions** MSCs can be transdifferentiated into SGCs in vitro, and they can be implanted into a fresh wound to form functional sweat-glands like structures.

**Key words** stem cells; sweat glands; regeneration