

TECH OFFER

iPS Cell-Derived Stem Cell Therapy for Fingertip Regeneration



KEY INFORMATION

TECHNOLOGY CATEGORY:

Healthcare - Pharmaceuticals & Therapeutics

TECHNOLOGY READINESS LEVEL (TRL): **TRL3**

COUNTRY: **JAPAN**

ID NUMBER: **TO175407**

OVERVIEW

This technology presents a regenerative medicine approach for treating fingertip loss by using nail stem cells derived from human induced pluripotent stem (iPS) cells. The loss of fingertip can arise from burns, trauma accidents, crush injuries due to heavy machineries and tools. Fingertip amputations are currently managed with conservative treatments that often result in shortening and deformation, with limited options for restoring full form and function. By leveraging the regenerative potential of nail stem cells, this therapy aims to achieve structural and functional regeneration of the fingertip, including nail reconstruction. A patent has been filed for the method of generating nail tissues and nail stem cells from human iPS cells, supporting future clinical translation and application.

Ideal Collaboration Partner: Pharmaceutical and biotechnology companies with an interest in advancing cell-based regenerative medicine therapies, particularly those with expertise in clinical development and commercialization.

TECHNOLOGY FEATURES & SPECIFICATIONS

- **Core Technology:** Differentiation of human iPS cells into Lgr6-positive nail stem cells, which contribute to nail formation and guide fingertip regeneration. Lgr6-positive marks a population of stem cells in the skin that can give rise to epidermis, sebaceous glands, hair follicles and reside in the nail matrix. Lgr6-positive nail stem cells support both nail regrowth and provide the epithelial signals needed to form a blastema for bone and soft tissue regeneration.
- **Mechanism of Action:**
 - Nail stem cells serve as the source cells for nail tissue.
 - Nail tissue indirectly stimulates fingertip granulation (blastema formation).
 - Nail structures provide a biological scaffold to support proper fingertip regrowth.
- **Preclinical Validation:**
 - In mouse models, transplanted nail stem cells formed keratinized structures supported by host vasculature.
 - Transplanted cells migrated to the native nail stem cell niche and successfully integrated.
- **Platform Advantage:** Use of HLA knockout iPS cells reduces the risk of immune rejection and supports allogeneic application.

POTENTIAL APPLICATIONS

- **Medical/Clinical:**
 - Treatment of fingertip loss resulting from trauma such as burns, crush injuries, and accidents.
 - Pediatric use where surgical reattachment is not feasible.
- **Cosmetic/Restorative:**
 - Nail reconstruction after injury or congenital conditions.
- **Future Directions:**
 - Foundation for broader regenerative medicine applications in nail and skin tissue repair.

UNIQUE VALUE PROPOSITION

The technology enables fingertip regeneration by reactivating natural regenerative pathways through iPS cell-derived nail stem cells. Unlike existing treatments that primarily preserve residual tissue, this approach aims to restore both form and function. The application of HLA knockout iPS cell lines makes the therapy more widely applicable by minimizing immune compatibility concerns, supporting development toward scalable clinical solutions in regenerative medicine.