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Cell therapeutics to treat diseases of the retina

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Background:

The adult Bone Marrow Stem Cells (BMSCs) have distinct advantages over the other types of stem cells. They are multipotent, can be stored for upto 10 years and considered to be one of the best sources of hematopoietic and mesenchymal stem cells in an adult body. Genetically inherited diseases such as Retinitis Pigmentosa and Degenerative diseases such as Age Related Macular Degeneration remain unsolved as no definitive treatment is available to repair the damages caused to the RPE and Photoreceptors as of now. In this scenario, the technique of Bone Marrow aspiration & isolation of Mono Nucleated Cells (MNCs) & intra-vitreal injection of a very small volume of MNCs in human retinal disorders has been standardized and is safe and feasible for human studies (Mohanty *et al*) and autotransplantation of RPEs from periphery to affected area are underpractice(Coffey *et al*). In this study we report our research work on different approaches to the above diseases using cell therapeutics.

Study 1

Materials & methods:

Ciliary Pigment Epithelium was harvested from donor eyes from Aditya Jyot Eye Hospital, Mumbai and was taken to and grown at NCRM lab. The cells were grown in the earlier reported methodology of Brenda *et al* (Science 2004).

Results:

The CPE derived Retinal stem cells grew well in the lab. However, the practical difficulties of harvesting the same in patients limited our further steps in this study.

Study II

Materials & methods:

Cadaver eye RPE cells were harvested and grown using polymer scaffolds after transporting them over 6 to 12 Hrs. The RPEs were grown on conventional methods and in polymer scaffolds and were subjected to RT-PCR.

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Results:

Human RPEs were able to grow without amniotic membrane and the same was proven by RT-PCR. This would make it possible for the peripheral RPEs taken from patients to be stored and later expanded and used for replacing the diseased cells of the central portion of the retina in future, without having to harvest the RPEs again.

Study III

Materials & methods:

Bone marrow mono nuclear cells were isolated and transported in cold containers (4-8oC) over a period of 6-12 Hrs and viability was evaluated.

Results:

The bone marrow mononuclear cells were viable up to 12 Hrs in our methodology with a viability of more than 95% making it possible for cells isolated from Chennai centre to be taken to Mumbai or any other destination within a reach of 12 Hrs for application as reported in earlier studies.

Conclusion:

The in-vitro expansion of RPEs without Human Amniotic Membrane is expected to open up a new possibility for treating the Retinal Degenerative Diseases. However an animal study is needed before clinical application. Intra vitreal application of Bone Marrow Mono Nuclear cells to treat RP and AMD as reported earlier are considered safe. We plan to undertake treatment and long term follow-up of more numbers of patients with RP and AMD.

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