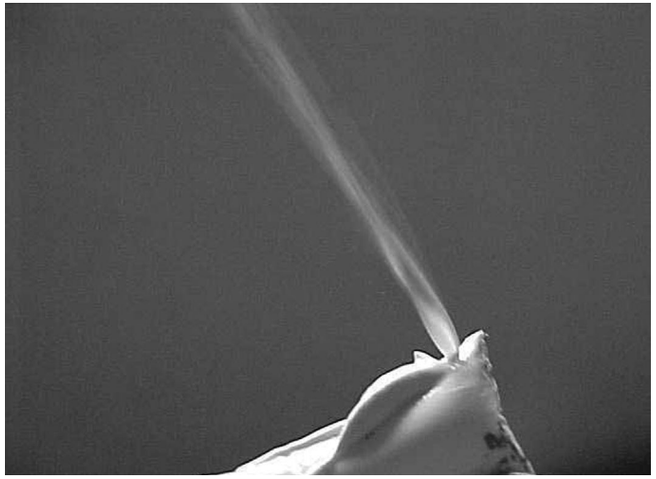


Laboratory simulation of chunna packet bursting on contact

LVPEI's stem cell laboratory

L V Prasad Eye Institute has a world class laboratory, the Sudhakar and Sreekanth Ravi Stem Cell Biology Laboratory, which was inaugurated by Dr APJ Abdul Kalam, President of India, in January 2004. It is supported by Sreekanth and Sudhakar Ravi, long term supporters of LVPEI, based in California, USA. The laboratory is named after them in recognition of their continuing support. The research work is supported by the Hyderabad Eye Research Foundation (HERF). The Department of Biotechnology, Government of India, gave a major grant for the work initially.

What can I do to prevent eye injuries?

The most common cause of injury leading to stem cell deficiency is *chunna* or common lime. At L V Prasad Eye Institute doctors have found that 80% of injuries that cause grave stem cell damage are caused by exposure to *chunna.* Parents and guardians must ensure that children never have any access to *chunna* packets. Adults must also guard against accidental exposure to flimsy packets of *chunna* as they may burst open.

If there is an emergency at night, during a weekend, or on a holiday, come for emergency care to the Institute. Always mention the patient's ID number, name and the doctor's name in all communications.

LVPEI
So that all may see

L V Prasad Eye Institute

Hyderabad
Kallam Anji Reddy Campus
L V Prasad Marg, Banjara Hills, Hyderabad 500034
Tel: 91 40 39892020 / 30612108; **Fax:** 91 40 23548339
Emergency Services: 91 40 30612100
Email: appointment@lvpei.org, info.hyd@lvpei.org

Bhubaneswar
Patia, Bhubaneswar 751024, Orissa
Tel: 91 0674 3989202 / 3987999 / 2725424; **Fax:** 91 0674 3987130
Emergency Services: 91 0674 3987220
Email: B.LVPEI-Appointment@lvpei.org, info.bbsr@lvpei.org

Visakhapatnam
GMR Varalakshmi Campus
Door No: 11-113/1, Hanumanthawaka Junction
Visakhapatnam 530040
Tel: 91 0891 3984555; **Fax:** 91 0891 3984444
Email: GMRV-Appointment@lvpei.org

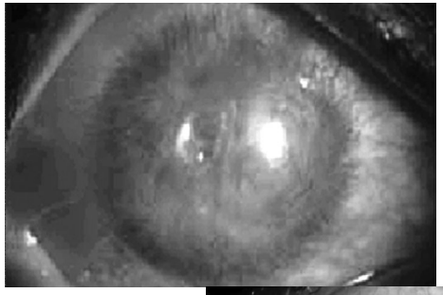
Vijayawada
Kode Venkatadri Chowdary Campus
Tadigadapa Village, Penamaluru Mandal
Vijayawada 521137
Tel: 91 0866 3062020
Email: kvc-appointment@lvpei.org

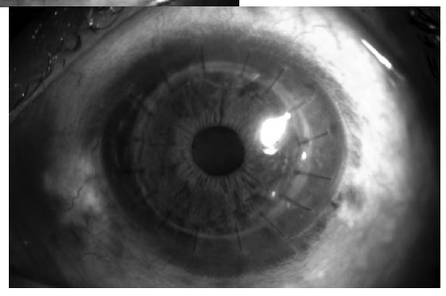
Website: www.lvpei.org

LVPEI
So that all may see

L V Prasad Eye Institute

Stem Cell Transplantation





Life begins as a single cell, which multiplies into millions of cells to develop into the person we become. However, as we grow older our tissues age and decay, calling for constant replenishment.

What are stem cells?

Most of our body parts have a constant turnover of cells due to normal wear and tear. For example, skin cells, blood cells, and cells in the mouth, food and windpipe all have a turnover. The body generates new cells to replace these worn-out cells through special reservoir cells known as stem cells, which have an unlimited potential for regeneration. These cells are called adult stem cells, and have two main functions. Firstly, they help maintain the cell population by replacing worn-out cells with new ones to ensure survival of a tissue, organ, or an organism. Secondly, they serve to repair tissues or organs where cells are lost due to injury or disease.

Different types of stem cells

There are two types of stem cells – adult and embryonic. Adult stem cells are committed to generate cells for their respective organs or tissues. They are already specialized according to their area and location and their scope is limited: skin cells will only become skin, cartilage will only become cartilage.

Embryonic stem cells, however, are undifferentiated cells that can develop into any type of adult cell in an appropriate environment or 'culture.' Embryonic stem cell research and its clinical application is still a subject of intense study the world over. L V Prasad Eye Institute does NOT do any embryonic stem cell work.

The need for stem cell transplantation

Sometimes due to injury, infection or disease in any part of the body, the stem cells may become excessively damaged, leading to an unusual or unrealistic demand for regeneration of new cells. In such cases the body may not be able to generate enough cells required to repair the damaged organ. This leads to a deficiency of cells and consequent dysfunction of the affected tissue or organ.

Until recently organ failure was treated with direct transplantation of donated organs and tissues, like liver transplants, kidney transplants, and heart transplants. The understanding of the functioning of stem cells made it possible to treat certain diseases by culturing these cells in the laboratory. However, the only areas where stem cells are probably being used clinically in human beings, globally, are blood disorders (bone marrow transplant) and eye diseases.

The stem cell transplantation technique involves 'culturing' or growing cells in the laboratory by taking a small bit of tissue, and then transplanting them into the area deficient in stem cells.

How are stem cells used for treating eye disorders?

All eye disorders cannot be treated with stem cells; only the front part of the eye can be treated.

The eye's outer surface is exposed to the environment, and has a constant turnover of cells to maintain the optical transparency of the cornea. These cells are regenerated from reserve stem cells, known as limbal stem cells, which are found in an area called the limbus. The limbus is a transition zone separating the central transparent cornea and the peripheral area **(See diagram of the eye showing the limbus)**. The function of limbal stem cells is to regenerate the epithelial (surface) cells of the cornea, while also serving as a barrier to ensure that the conjunctival cells do not grow over the cornea and mar its transparency.

Limbal stem cells help regenerate the surface of the cornea when there is any decay or damage. However, in cases of chemical burns, allergic reactions to drugs and auto-immune diseases, the limbal stem cells may become damaged and lose their ability to regenerate new cells. This condition is known as 'limbal stem cell deficiency' (LSCD). This deficiency can be made up in two ways: by direct limbal transplants or by culturing the limbal cells in a controlled environment and transplanting them. The raw surface of the eye causes pain, redness and decreased vision.

The damage to the limbal cells may be partial or total; it may be unilateral/in one eye or bilateral/in both eyes. Based on the extent of damage, doctors make a clinical decision whether a graft from the same eye will be sufficient, or whether there is a need to take it from the other eye. There are two types of grafts – allograft and autograft. In allograft the cells used for culturing are taken from a relative or donor, while in autograft the cells for culturing are taken from the patient.

Stem cell transplantation at LVPEI

In 2000, LVPEI initiated research on limbal stem cells, by harvesting a small bit of limbal tissue from a patient's good eye, growing it in the laboratory and transplanting it back into the patient's eye. This procedure, direct limbal stem cell transplant, was performed on a patient for the first time in April 2001. Till date over 750 patients have been treated at LVPEI with this technique, with almost 70% success. Thirty patients also underwent corneal transplantation with good visual recovery in 80% cases.

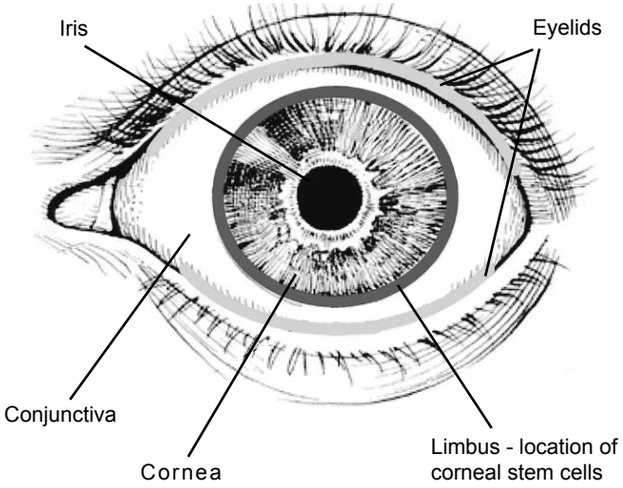


Diagram of the eye showing the limbus

Limbal stem cell culturing is useful for patients needing large amounts of stem cell replacement, where too many cells taken from the donor eye may cause a deficiency there. In autograft the patient's own tissue is used (after culturing) to treat the diseased eye. This reduces the risk of rejection, as compared to a donor tissue. Autograft also implies minimal use of steroid immuno-suppressants, which means avoiding life-long dependence on drugs, as well as reduced side-effects of drugs. Moreover, doctors can see the cells growing in the laboratory every day, which is not possible in cadaveric transplants.

The surgery

The procedure involves a relatively minor surgery to remove the tissue, which is then cultured in a laboratory on a human amniotic membrane. After almost a fortnight it is then transplanted into the patient. Following surgery, the patient is checked in the clinic, with follow-up visits scheduled every 4-6 weeks till it is found satisfactory.