



Skin For Life: Skin Donation And Skin Banking

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ABSTRACT

Donate Skin Save Lives. The body's main defence mechanism is its largest organ, the SKIN, which is destroyed in burn cases and leaves the body vulnerable to infectious invaders. Patients are at risk for infection, fluid loss and eventually death if the burnt region is not immediately covered with appropriate skin substitutes. Use of *Cadaveric Skin* (skin donated after death) improves the chance of survival by 50% as it shields burn victims against infections and helps in faster recovery with less pain and fewer scars. India, the second most populous country in the world has an estimated annual burn incidence of 6-7 million, which is the second largest group of injuries after road accidents and most of them are from the lower or middle income group. Therefore, it is essential to develop a cost-effective method of treating the affected population. In such situation, cadaveric skin harvested from the deceased person is the efficacious and most suitable option, in contrast to synthetic skin substitutes. Despite being a temporary covering such skin is crucial since it promotes the reproduction & growth of the patient's own skin. Many patients who could not have been saved without cadaveric donor skin can be saved now. Hence, the Skin Bank is a beneficial fortune for providing cadaveric allograft skin. Voluntary Skin Donation and Skin Bank are the cornerstone of safe skin transplantation. But due to lack of awareness of this facility and shortage of enough banks in our country, we are losing patients everyday. According to the report of National Crime Records Bureau (NCRB), 2020, thirty-five Indians died in fire accidents daily between 2016 and 2020. Skin transplantation is not limited to the cases of burn accidents, but with the country's changing health needs and evolved facilities, this has expanded to cover the patients being treated with critical skin issues, acid attack victims and similar interventions. But several reports have attested to a shortage of donor skin across the burn healthcare facilities in India. Therefore, the purpose of this study is twofold, firstly to assess the knowledge of Skin Donation and Skin Banking among the general population and secondly, to enhance the need of skin donation and skin bank to ensure its accessibility and availability at the point of demand. *"After all every life counts."*

- **Methods:** A validated self administered questionnaire based study was utilized to acquire assessment of the adult general, population knowledge, awareness and attitude toward skin donation, to help solve skin shortages due to lack of skin banks in India especially in northern region. The participants of 57 were selected randomly in selected urban cities of Northern India Data was collected by using semi-structured knowledge questionnaire, which consists of 15 questions of knowledge regarding Banking and Skin Donation.
- **Results:** A total of 57 individuals completed the questionnaire over the period of two months from June till July, 2022. The study shows that, out of 57 people, 79% had inadequate level of knowledge, 21% had moderate level knowledge, and none of them had adequate level of knowledge and Awareness regarding skin banking.
- **Conclusion:** The analysis of the study indicates that there is a lack of sufficient knowledge and awareness regarding the life saving concept of skin Donation and Skin Banking. Thus, the study emphasizes the need of active support and participation of the health-care professionals, educational Institutions and the alert citizens in raising the public awareness regarding the Skin Donation and Skin Banking, which can help in saving lives of several young and productive members of our society.

Key Words: Awareness, Burn, Skin Donation, Skin Banking, Cadaveric Skin.

INTRODUCTION

*“We Make a Living By What We Get,
But We Make a Life By What We Give”*

--- Sir Winston Churchill

BURNS are a serious health problem that significantly affect various sectors of the population and range in age and severity. A sizable portion of the patient's skin may suffer serious damage as a result of burn injury. Thus, the treatment of deep and extensive burns requires expertise. The optional method of treatment for severe skin burns is to perform an autologous split thickness skin graft (STSG) donated from a body part with intact skin.¹ However despite total tissue compliance which should be considered the main advantage of STSG, such graft have a number of disadvantages and limitations (e.g. creation of a new wound-donor site, infection risk, pain, scarring etc).² Burns also represents an extremely stressful experience for both the burn patients and their families.³ In this aspect human allergenic skin transplants play a critical part in the care of burn patients and skin banks may be one of the essential institutions in that care. The cadaveric donor skins used as a temporary dressing for severe burns patients who do not have enough healthy skin on their body that the surgeon can use as graft onto their wounds.⁴ The donated skin helps relieve the patient's pain and discomfort, prevents risk of infection and minimizes fluid loss and the hospitalization time.⁵ Thus, the skin bank and skin donation has high benefit to the mankind by providing cadaveric human skin which can make the treatment easy, safe and economical for the burn patients. However in a developing nation like India there are serious gender based



social inequities, about 7 million people suffer from burn injury every year and of which 1.4 lakh people die.⁶ According to the Union Ministry of Health (Govt. of India) around 4 out of 5 burnt cases are of women & children.⁷ 70% of the burn victims are in most productive age group of 15-40 years and most of the patients belong

Burns Scenario in India

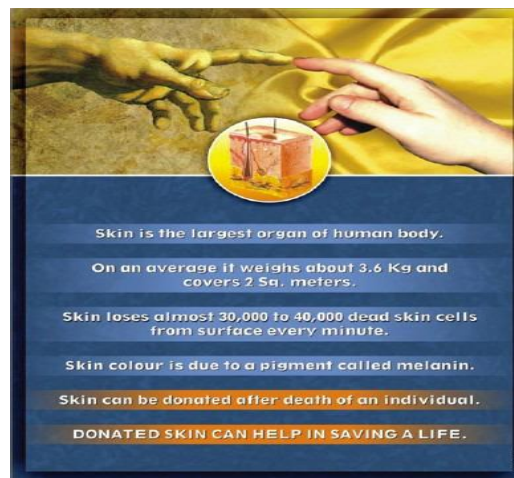
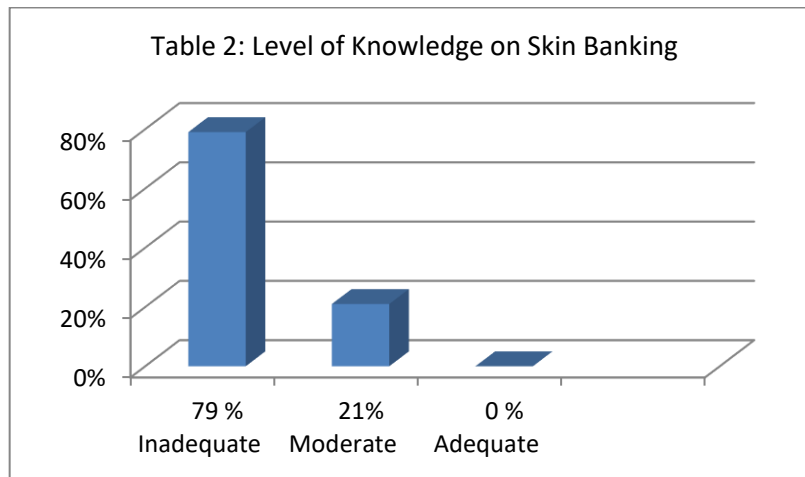
to the poor socio-economic group.⁸ Accidental burns occur due to cooking in open fire, cooking on floor, kerosene stove and not taking necessary precautions at home and work spot. Non-accidental burns occur as a result of bride burning, personal disputes, child abuse and acid attacks. Due to severe burn/chemical injuries, they require multiple surgeries and prolonged rehabilitation.⁹ Out of 10% of these which are life threatening around half succumb to death.¹⁰ Despite many medical advances, burns continue to remain a challenging problem in India, due to lack of infrastructure, trained professional, the increased cost of treatment as well as an inadequate number of skin donors which in turn results from the current Indian tissue donation system.¹¹ All those who can donate eye, can donate their skin too but because of lack of awareness and such facilities, the skin donation has not picked up in our country, especially in Northern India where unfortunately not a single skin bank has been established yet. Therefore, the organizational, legal and systematic changes are required to improve the situation in Indian transplantology with particular emphasis on skin donation.

OBJECTIVES OF THE STUDY

- To assess the knowledge and awareness on the concept of skin donation & skin banking among the general population.
- To emphasize the important role of human allergenic skin transplants in the treatment of burn patients.
- To enhance the need for more Skin Banks in India.
- To identify the potential reasons for the low rates of skin donation in India.

METHODOLOGY:

A non-experimental descriptive research survey was used to assess the knowledge and awareness of skin donation and skin banking among the general population in the northern region of India. The survey was conducted during the period from June 2022 to July 2022, in selected urban cities of Northern India at Rupnagar, Ludhiana, Patiala, Jalandhar, Ambala, Panchkula, Nahan, Nalagarh, Bilaspur, Nangal, Shri Anandpur Sahib including the UT Chandigarh. A total of



Skin Donation Awareness Poster

HISTORICAL BACKGROUND

The first report of skin grafting dates back to the second century BC, when the Indian surgeon **Sushruta** used auto-grafted skin for rhinoplasty.¹² Skin autografting was first described by **Reverdin** in 1871.¹³ At the end of the last century (1881), **Girdner** was the first to report the use of all skin to cover a burn wounds.¹⁴ However, it wasn't until 5 years later that **Thiersch** described the histologic anatomy of skin engraftment and later popularized the clinical use of split thickness skin grafts.¹⁵ Until the beginning of the 20th century, it was not possible to bank skin because it was difficult to maintain tissue viability. Modern skin preservation began with successful storage at +4°C and +7°C by **Webster** and **Matthew**, respectively.¹⁶ After experiments with refrigerated cow skin, Webster managed to successfully store fresh human skin autografts for 3 weeks. During World War II and the Vietnam War, numerous studies were conducted on skin allografting to treat military burns and wounds.¹⁷ However the first proper skin bank was the US Navy Skin Bank set up in 1949.¹⁸ The first tissue bank in Europe, the Yorkshire Regional Tissue Bank, was established in England in 1960; the Dutch National Skin Bank in the Netherlands followed this, in October 1976. With the further evolution of techniques to preserve skin, the Euro Skin Bank was opened in 1992. Overcoming all the hurdles, discouragements and difficulties, the first deceased donor skin allograft bank in India became functional at LTM Medical College and General Hospital, Sion, Mumbai on 24th April 2000 which was the only skin bank till 2009. In 2009, a collaboration of the National Burns Centre Mumbai, Rotary International, and Euro Skin Bank developed an effective model of skin bank and started functioning in 2013.¹⁹ Other skin banks working are at Choithram Hospital, Indore; Ganga Hospital, Coimbatore; Government Stanley Hospital, Chennai; Orange City Hospital, Nagpur; Right Hospitals, Chennai, Surya Sahyadri Hospital, Pune; and Victoria Hospital, Bangalore, Cuttack, Bengaluru, Rajkot (Gujarat).²⁰ Despite this there is not a single skin bank in Northern India. .

SKIN DONATION

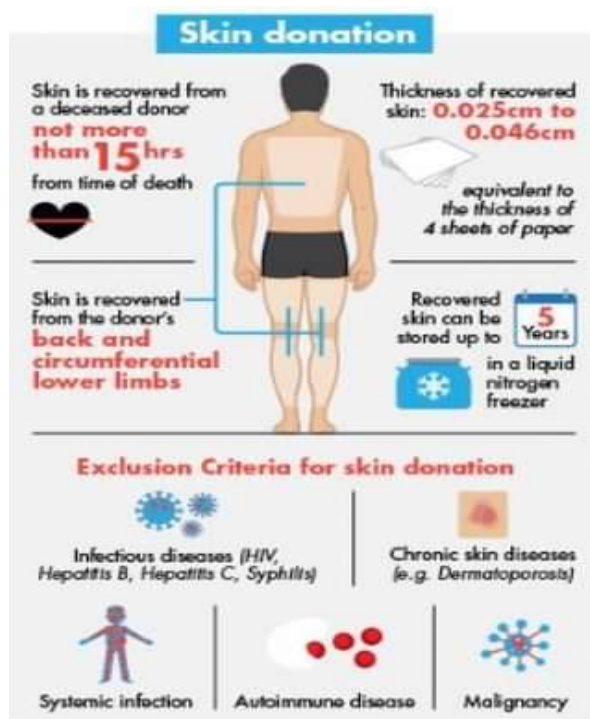
Donating a person's skin after the death is known as skin donation. Skin is the largest and only organ in our body that can repair itself, which protects us from harsh external conditions.²¹ It also regulates the temperature of in our body. But if it gets burn then the skin loss its capability to repair itself. If the burnt area is not immediately covered with some skin substitutes then patients are prone to infection, fluid loss, dehydration and ultimately death.²² In India 100% mortality is observed in patients having more than 60% burns because patient's own skin is not enough to cover the burnt areas. In such scenario, human allograft is the best option.²³ These allografts can be taken from the living donors but it is very

painful to take out the skin and leaves some scars behind.²⁴ Hence, Cadaveric skin is the best alternative which can cover the burns wounds although temporarily but will be instrumental in saving the life of such patients. Around 80% of such patients can be saved, if we have enough skin in skin bank.²⁵ Anyone can donate skin since there is no cross-matching required. Hence, donated skin is the way to help promoting wound healing.²⁶

“When you donate eyes, you give sight when you donate skin, you give life”

WHY SKIN DONATION IS SO IMPORTANT

- Skin is usually donated to burns, diabetic, trauma and acid attack patients.
- Donating your skin after death saves lives of at least two burn patients.
- The applied skin serves as a biological bandage for the patient.
- It resurfaces the exposed body and prevents the entry of bacteria.
- Controls the loss of protein, heat and fluid from the body.
- Give patients enough time to develop own skin.
- Anyone can donate skin as there is no cross matching of blood is required.
- Lesser hospital stay.
- Cost of treatment goes down
- Reduced pain
- Increase survival rate.



HOW AND WHEN CAN ONE DONATE SKIN?

Anyone can donate skin after the death irrespective of sex & blood group, the minimum age of the donor should be 18 years but there is no upper age limit, even a 100-year old person can donate the skin and it will be used for the treatment.²⁷ Skin can be donated within 6 hours from the time of death. But, skin of persons suffering from AIDS, Hepatitis B&C, Sexually Transmitted Diseases, Skin Cancer, Active skin disease and septicemia are considered unfit for donation. At the time of skin harvesting, blood sample from the body of the deceased is also taken and necessary test for HIV, Viral markers & Hepatitis is carried out at the Skin Bank.

SKIN PROCUREMENT

Skin harvesting procedure is very simple but standard protocol for graft-harvesting methods has to be followed. It is performed by Skin Donation Team consisting of one doctor, two nurses and one attendant. A special instrument called **DERMATOME** harvests skin, it is a battery operated instrument made exclusively for skin harvesting only.²⁸ Skin Bank Team will come to the donor's home, hospital or morgue, wherever the donor is kept. There is no need to shift the donor to the operating room, hospital or ambulance. The whole procedure takes only about 30-45 minutes.²⁹ Skin is harvested from both the legs, both the thighs and the back. There are only 3 layers of skin and only the 1/8th layer i.e. the uppermost layer of the skin is harvested.³⁰ In this procedure, there is no bleeding from the site where the skin is harvested from and there is no disfigurement to the body also. After the procedure, the team bandage the parts from where the skin is removed in a proper way.³¹ It is not even visible to persons who come to pay their homage. The grafts

are transported to the skin bank in Phosphate buffered saline in glass containers placed in ice box along-with blood sample. About 10cc of blood of the deceased is collected at the same time for serological testing.³²



Graft taken form patient's healthy skin by Dermatome

Skin is Meshed to cover a large wound.

Once the skin is harvested, the area is covered properly with bandages

LEGAL REQUIREMENTS

A doctor will take consent of the next of kin of the donor and also a witness is required to sign the consent form before the start of the skin harvesting procedure.³³ The whole procedure will be explained to the family by the Doctor. There is no need to pay anything to the Skin Donation Team. Selling & buying organs is illegal.³⁴ The death certificate has to be produced and its photocopy will be evaluated by the team Doctor before starting the procedure.³⁵

THE SKIN BANK

The Skin Bank is a valuable resource in providing cadaveric allograft skin as a cover for partial thickness & full thickness burn injuries.³⁶ It is a place where skin collected from eligible deceased donor is processed and distributed as per International Protocols. After recovery from a donor, skin is tested for infection, processed & frozen until needed. Skin Bank is a service, it is not a product. It can only work with the cooperation & coordination of the people, for the people. The skin bank team consists of counselor, contact person, response team including surgeon, assistant, helper, supervising consultant, microbiologist or biochemist record keeper.³⁷ Permission for establishing a skin bank with procurement of deceased donor skin allograft has to be obtained from appropriate authority of the government.³⁸ Though skin is an organ, split thickness skin graft (STSG) is considered as a tissue. Successful functioning of skin bank demands constant vigilance, quality control & a team of dedicated members. Phases of skin banking establishment-

- Setting up the necessary Infrastructures and equipments.
- Recruiting manpower
- Creating awareness about skin donation
- Quality Management system for consistent quality.
- Retrieval Processing
- Medical documentation
- Storage.

“Unless we donate skin there is no value of skin bank, so please donate skin”

STORAGE OF HARVESTED SKIN

Initially the harvested skin is stored in 50% Glycerol for two hours at 4-6 degrees C for 2 hours. Then it is checked for any infection and the put in 85% Glycerol for 3 hours at 33 degrees C in a shaking incubator.³⁹ Then the skin is kept in a freezer at 8 degrees C for 4-6 weeks until the serological reports are available. After 4-6 weeks the graft is transferred to a bio-safety cabinet and made into smaller uniform strips.⁴⁰ The skin is then preserved in 85 per cent glycerol in a temperature of 4 degrees and it is ready for use. The treated cadaveric skin has a shelf-life of four to five years.⁴¹ The stored graft is checked every 3 months for bacterial or fungal infections. The stored graft is used for treating patients with damaged skin due to burns or injuries.⁴²



Glycerol Allograft

THE REGULATORY AUTHORITY

Though skin is an organ, split thickness skin graft (STSG) is considered as a tissue. In India donation and transplantation of human organs and tissues is governed by the TRANSPLANTATION OF HUMAN ORGANS & TISSUES ACT (THOTA) 1994 and amended in 2011, in which tissues have been included along with the organs. This Act provides a system of removal, storage & transplantation of human organs & tissues for therapeutic purposes & for the prevention of commercial dealing in human organs, to guarantee the safety of indigenous allografts. In pursuance to the amendment Act 2011, Transplantation Of Human Organs & Tissue Rules 2014 have been notified in March, 2014. National Organ & Tissue Transplant Organization (NOTTO) is established under the Directorate General, Health Services as per the mandate of the Act and as stipulated by World Health Organization guidelines, which function as apex centre for all India activities of coordination & networking for procurement, distribution, registry & transplantation of organs & tissues in the country. Regional Organ & Tissue Transplant Organization (ROTTO) are identified institutions which are champions in the field to take care of a group of state. State Organ & Tissue Transplant Organization (SOTTO) is an institutional mechanism to support the states. Registration of tissue banks, compliance with the national standards & the appointment of transplant coordinators in hospitals registered under the act are now mandatory. Being a member of Asia Pacific Burn Association (APBA) had adopted a new set of harmonized guidelines for skin banking in Therapeutic Application in 2019, which offer a comprehensive manual, addressing, governance & contracts; staff responsibilities; quality management; facilities; equipments & supply management; donor consent, testing and recommendations of good practices pertaining to skin recovery, processing, storage & distribution.⁴³

SKIN DONATION AND SKIN BANKING: GREAT NEED OF THE HOUR ESPECIALLY IN NORTHERN INDIA.

India witnesses an average of around 7 million burn trauma cases each year. Burn related mortality is very high due to lack of allografts leading to high infection rates and most patients require skin grafting. But only 2% of the requirement is fulfilled here.⁴⁴ According to the reports⁴⁵ from 2011 to 30th Sep. 2019, skin donation after death has been received from 900 donors. The donation was procured from 478 men & 422 women. The procurement was within six hours of death of majority of donors. Till date the skin allografts have been used for 869 patients all with burn extent of more than 40% total body surface area. Despite this, India has only 16 skin banks and out of which there are only two government backed Skin Banks – one is Sion Hospital, Maharashtra & other at Bangalore Medical hospital. Awareness also plays an important part in ensuring that people donate skin but we are lacking on that part as well. Why is there still no active involvement by the state to address the acute lack of publically supported mechanism for skin preservation and usage, when immediate surgeries have the capability to save lives? ⁴⁶ Why the victims do not receive high-quality treatment without having to travel more 1,000 miles or shilling out the entirety of their savings? The prohibitive cost of treatment and rehabilitation and most victims being poor explain the gross shortage of specialized skin banks along with the burn units in government sector and reluctance on the part of the private players to share the burden. As per the National Crime Records Bureau (NCRB), eastern regions have the highest incidents of acid violence accounting for nearly 37%, southern region with 15%, Northern region with 35% and western region with 13%. Regardless of this, there was not a single Skin Bank in Northern India until 2023 and the knowledge regarding the concept of Skin Donation is very poor among the general population there. The recent rise in the incidents of terror activities and manmade disasters contributing to quantum jump in Burn injury cases, also calls for the national preparedness to cope up with the challenge of this public health problem. Thus, there is “An Urgent Need To Establish Skin Banks” in each and every part of our country which can save the lives of thousands of people and offer them a much better quality of life-

- Half of the burn patients who are dying now can be saved if more skin banks are established in the country to collect more skin for covering extensive burn wound after early excision.
- The skin allografts in the skin bank act as the most effective dressing and a barrier to infection & the rate of infection is reduced significantly.

- Early removal of dead skin and homografting will lead to quicker healing with less scar.

THE POTENTIAL REASONS FOR THE LOW RATES OF SKIN DONATION

Donating Organs is a kind deed that demonstrates our concern for our fellow humans who really need these organs. In an ideal situation, giving an organ is purely a selfless act, with no ulterior intentions on the part of the donor. India culture takes pride in ethical principles like altruism and selflessness.⁴⁷ This is depicted by a well known mythological story of the sage 'Dadhichi, who donated his bones for making weapons in order to help the Gods to defeat the demons and reclaim the heaven.⁴⁸ In another mythological tale, King Shibi donated his own flesh to a hawk in order to save the life of a dove.⁴⁹ King Shibi also offered both his eyes for the restoration of a blind man's sight. There are countless such instances support the idea that India culture and values favour organ donation. But the actual organ donation rates of 0.16 per million population in India are immeasurably low as compared to America and Spain.⁵⁰ India has high incidence rate of burn injuries about 7 million each year & most of the burned victims require skin grafting but only 2% of the requirement is fulfilled. Therefore, in such grim situation, it is essential to identify the reasons for the promotion and positive growth of skin donations and skin banking-

- **Lack of awareness among the general population:** Lack of knowledge and awareness appears to be the most important factor for the low skin donation rates in India. The organ donors come from the society. The knowledge, socio-cultural views and awareness among various population groups in the society shape the attitudes of people toward the concepts of skin donation & skin banking. People in India know about various organ donations like eyes, blood, kidney, liver, heart but they are not aware that they can donate their skin too. For the lay people it is an alien concept.
- **Religious beliefs and superstitions.** Different religious beliefs and myths are the reason for the acute shortage of human allografts in our country. There are various misconceptions related to disfigurement and religious faiths that need to be addressed.
- **The geographical distribution of these skin banks & services availability are uneven and heterogeneous⁵¹**- Despite the scenario of high rate of burn injuries and mass fire disasters and mortality, India witnesses only 16 skin banks in the entire country. Unfortunately, there is not a single skin Bank has been established yet in the northern region.
- **There is no active involvement of the government to address the acute shortage of skin donations-** In most countries in the world skin donation is linked with organ donation program and hence comprehensive counselling is undertaken. Unfortunately, such program does not exist in our country till today. The efforts on the part of the government in the awareness and promotion of skin donation is relatively lacking.
- **Lack of infrastructure and trained professionals-** Despite many medical advances the minimal rate of skin donation continue to remain an intricate issue in Indian burn healthcare program, due to lack of infrastructure and trained professionals.
- **The time period between death and the final rites:** Donor families who have lost a close relative are often anxious about the delay in conducting last rites of the patient. The family sometimes is very concern about the delay.
- **The non acceptance of brain death as death⁵²**- Estimates show that 4 lakh people die every year while waiting for an organ transplant. Organs can be harvested from a patient who has been declared brain dead but doctors find that relatives often confuse brain death which is irreversible with the state of coma, which can be reversed. Another bigger problem is the inability of the hospitals in identifying, certifying and maintaining a brain-dead patient.
- **The need for transplant coordinators is critical:** The transplant coordinator needs to address concerns and counsel a potential donor family.
- **Lack of faith & trust of people in the Indian healthcare system.** This is a serious issue and needs to be addressed because the faith & trust of people are very important for the success of any healthcare program or initiatives.⁵³
- **Dismal on the part of the family of the registered when actual time for skin donation comes:** There is a huge difference between what people feel or say about skin donation and the actual behaviour when such a situation arrives. In the most incidents there is dismal on the part of the family of the registered donor when the time for actual skin donation arrives.

CONCLUSION

Organ Donation is the biggest contribution to the humanity. It not only save lives but also touches and changes the other lives associated with the one who receives the organ. The greatest post- death gift is actually organ donation, which

allows one to continue to improve people lives long after their earthly existence have ended. There are several types of organ and tissue donation. Donation of eyes and blood has become a widespread practice, but people are still not aware of skin donation. Highlighting and talking about such causes openly and even on public platforms will help spread the word. Popularizing of skin banking in our country can be done through the following devised strategies-

- Through regular awareness programs at the medical institutions/colleges, educational institutions, at clubs, housing societies, cultural or religious gatherings, BSF functions, corporate offices, the courts, banks and the public places & social service organizations.
- Brochures, posters flipcharts, power point presentations, education films, articles in print media, television interviews, radio talks, information Kiosk during trade fair, Walkathon, newspaper advertisements, sending SMS to mobiles on regular basis will create awareness among the public.
- Development of burn survivor community and their interaction with the public will be more effective.
- Multi-disciplinary partnership and participation of voluntary organization need to be coordinated. Every hospital should have in-house skin banking facility. Several collection centres can be affiliated to each skin bank facility..
- Skin Donation must be linked with the organ donation program so that comprehensive counselling can be done.
- Burn care professionals should come together to formulate guidelines and to provide assistance in the establishment of new skin banks. It is vital to ensure the quality in functioning of skin bank. So, the establishment of Tissue Bank Association of India will be logical step in the right direction.
- The fundamental strategy to ensure timely access to safe and sufficient supply of human skin allografts is to develop a national coordinated skin transplantation service based on voluntary non-remunerated skin donations.
- Teaching of patients and their relatives on a regular basis about deceased organ donation and urging them to disseminate this knowledge further.
- Motivation of general public for organ donation by using interviews of actual organ recipients leading a normal life following transplantation and acknowledging the 'gift of life' from an unknown donor. This may also be helpful for the donor family to cope with the grief.
- Healthcare institutions and Zonal Organ Donation banks in our country should use these methods to spread awareness regarding skin donation.
- Involvement of popular television and film celebrities for spreading awareness. Introducing storylines bout skin donation into the popular television programs and films are other important strategies that may help improve the donation rates.
- There must be active participation of the government to promote skin donation in India.

Hopefully through these strategies the rate of skin donations can be increased & will also helpful in the establishment of more skin banks in the entire country. This will improve the survival probability of the patients with large burns. Thus, we all need to join hands to ensure that we can save as many lives as possible and help their meaningful return to the family and society. India is able to set off on a path to a developed and comprehensive strengthened health system that is based on local needs with a holistic approach by ensuring attention to each and every component of the healthcare system.

*"Be remembered forever for the noble path you've paved,
Be remembered forever for the lives you've saved".*

End Notes

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