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From cadaveric donation to cryopreserved total skin allografts: Transforming the Chilean skin donation model

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ABSTRACT

Background: The clinical utility of skin allografts (SA) is well established. However, the donation and procurement of cadaveric skin—historically the primary source of SA—remain limited in many countries. A skin donation model based on the use of excess surgical tissue from body contouring procedures was introduced and compared with the traditional cadaveric donation model.

Methods: A retrospective review of skin donations in Chile was conducted over two periods (2017–2019 and 2022–2024), analyzing the performance and characteristics of two donation pathways: cadaveric and living donors.

Results: During the first period (2017–2019), four cadaveric donors provided a total of 10,959 cm^2 of skin. In the second period (2022–2024), 353 donors contributed 153,585 cm^2 of skin, of which 348 were living donors (131,997 cm^2) and five were cadaveric (21,588 cm^2).

Conclusions: Initially conceived as a complementary strategy, the living donor model has evolved to become the primary source of skin allografts in Chile. This approach significantly increases the availability of SA, broadens therapeutic indications, and promotes the concept of transforming excess surgical tissue into valuable therapeutic resources. Moreover, it enables the production of cryopreserved full-thickness skin allografts (CTSA), which serve not only as temporary wound coverage but also as dermal regenerative scaffolds, particularly beneficial in the treatment of burns affecting functionally and aesthetically critical areas. This new paradigm supports a more accessible and sustainable culture of skin donation while offering promising benefits for regenerative burn care.

1. Introduction

The treatment of patients with extensive and deep burns represents a highly complex clinical challenge. Patient survival depends, on the one hand, on appropriate initial resuscitation and life support, and on the other, on the timely execution of surgical procedures that ensure early skin coverage [1,2]. In many cases, the urgency to cover open wounds necessitates the use of skin substitutes, among which skin allografts (SA) have proven to be essential tools within the therapeutic arsenal [3,4]. Historically, the use of SA was linked to altruistic practices, initially involving grafts donated by family members or even members of the surgical team themselves [5,6]. However, the ability to obtain larger

Abbreviations: SA, skin allografts; CTSA, cryopreserved total skin allografts; HIV, Human Immunodeficiency Virus; VDRL, Venereal Disease Research Laboratory; HTLV, Human T-cell Lymphotropic Virus; ICUs, intensive care units; ADM, acellular dermal matrices.

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skin surfaces without endangering the donor, a better understanding of the immunological mechanisms involved in graft rejection and acceptance, and the development of skin banks allowed for a transition to a cadaveric donation model. This model standardized the procurement process and ensured both the biological quality of the tissue and high biosafety standards, effectively dissociating the donation from any personal relationship between donor and recipient [7–9]. Nevertheless, in many countries, cadaveric skin remains the only available source of SA in tissue banks, and its use continues to be subject to social, cultural, and religious debate [10]. These limitations, coupled with low post-mortem donation rates, have driven the search for alternative models. In this context, skin donation from patients undergoing body contouring surgery has emerged as a viable strategy, transforming surgical waste into a therapeutic by-product. This alternative not only increases tissue availability but also promotes a more accessible and sustainable donation culture [11–14]. In parallel, advances in critical care and surgical management of major burns have significantly improved survival rates. However, these successes are frequently accompanied by considerable functional and aesthetic sequelae, largely due to the limited dermal contribution of conventional autografts and the use of secondary intention healing [15]. In this scenario, the need to develop coverage strategies that not only provide temporary wound closure but also deliver or stimulate neodermis formation has become increasingly evident [16]. This is essential to reduce scar contracture and optimize long-term functional and aesthetic outcomes—particularly in anatomically sensitive areas such as the face, neck, hands, feet, joints, perineal and genital area, periocular region, and auricle. This study aims to describe and compare the classic cadaveric skin donation model with a living donor model based on the use of surgical residues from body contouring procedures. A retrospective analysis of skin donations in Chile was conducted covering two periods (2017–2019 and 2022–2024), evaluating their characteristics, advantages, limitations, and clinical implications in the treatment of burn patients, with particular emphasis on the development and use of cryopreserved total skin allografts (CTSA).

2. Materials and methods

A retrospective review of skin donors was performed in Chile using information from a database of the Chilean integrated system of organ and tissue donation and transplantation from January 1, 2017, to December 31st, 2024. Years 2021 and 2022 were not considered because of the COVID-19 pandemic and a severe incident that affected the national tissue bank, specifically a conflagration that destroyed hospital facilities. For statistical and comparative purposes, the period evaluated was divided into two triennia: the first from 2017 to 2019 and the second from 2022 to 2024. During these intervals, we described two skin donation models: cadaveric donation and living donor donation. It is important to mention that all patients, regardless of the skin donation model, underwent laboratory tests (hepatitis B surface antigen, hepatitis C antibodies, HIV antibodies, VDRL, HTLV-1 and 2, Chagas disease), in addition to tissue cultures (aerobic, anaerobic, and fungal), to prevent SA from acting as vectors for infectious diseases [17].

3. Ethics

All procedures and protocols were performed under the supervision of the National Coordination of Organs and Tissues Transplantation of Health Ministry of Chile, with the authorization of the regional Ministry of Health from Tarapacá, and with the consent of the Ethics Committee of the Tarapacá Health Service (ACTA SEC SSI Número 3/2022).

4. Skin donation model in the cadaveric donor

Skin donation from cadaveric donors is performed during multi-organ donation and/or throughout the pathological anatomy of the deceased individual. Although the process may vary slightly depending on the country and local regulations, general steps are common and can be divided into six stages as described below (Fig. 1). [17–19]

1. Detection: Identifying a possible donor is mainly performed in intensive care units (ICUs) and emergency services. Subsequently, the local transplant coordinator was notified to begin the evaluation process and eventual procurement.
2. Evaluation: Once donor candidate has been identified, local procurement coordinator evaluates their background and clinical conditions to admit or rule him out as a potential donor.
3. Death diagnosis: Is certified through cardiopulmonary or neurological (brain death) criteria.
4. Maintenance: Once the neurological and/or cardiopulmonary criteria are met, management focuses on supporting, protecting, and optimizing the functional performance of all organs and tissues selected for transplantation.
5. Consent: Donor's prior consent is verified (registered while alive), or authorization is requested from family.
6. Procurement: This is performed by trained surgical teams following a logical and orderly sequence. The extracted skin is stored in preservation solutions and transported under strict temperature control for a limited time to the corresponding tissue banks, where it is processed for subsequent clinical use.

5. Skin donation model in living donor

The living-donor skin donation model is based on the utilization of surgical waste from patients undergoing body contour surgeries, mainly abdominoplasty and breast reduction. This model can be divided into the following stages (Fig. 2) [20].

1. Detection: Originates of plastic surgery consultations, looking for surgical table programming in hospitals and clinics that act as skin-generating centers, giving them an extra reminder of this agreement when necessary. Plastic surgeons propose to patients the possibility of donating their own surgical skin waste from their surgery. When scheduling the procedure, the procurement unit and tissue bank are notified to arrange the dispatch of all necessary supplies for the process and arrange tissue transportation logistics.
2. Evaluation: Once surgery is scheduled, the background of the potential donor is evaluated, considering inclusion and exclusion criteria.
3. Diagnosis of death: Not applicable.
4. Maintenance: Not applicable.
5. Consent: Patient gives consent for donation directly during planning and consent of the original surgical act.
6. Procurement: Resection of the dermo fat flap is inherent in primary surgery; therefore, extractor equipment is not required. The skin obtained is preserved in a specific preservative solution and transferred to the corresponding tissue bank, fulfilling rigorous temperature controls and established times, where it is subsequently processed and prepared for clinical application.

6. Results

a.2017–2019 Triennium: Four donors were registered, contributing 10,959 cm^2 of skin. Notably, all donors were obtained using a cadaveric model (Table 1).

b.2022–2024 Triennium: During this period, 353 tissue donors were registered, contributing a total of 153,585 cm2, distributed as follows:

i. Cadaveric model: Five skin donors were registered with a total surface area of 21,588 cm2.

ii. Living donor model: A total of 348 donors were registered with a total surface area of 131,997 cm2 of skin procured (Table 2).

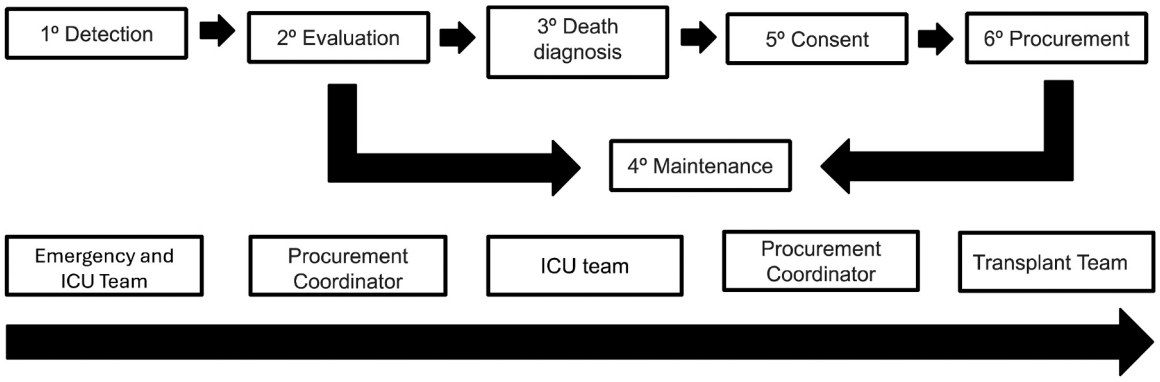

Fig. 1. Skin donation model in cadaveric donors.

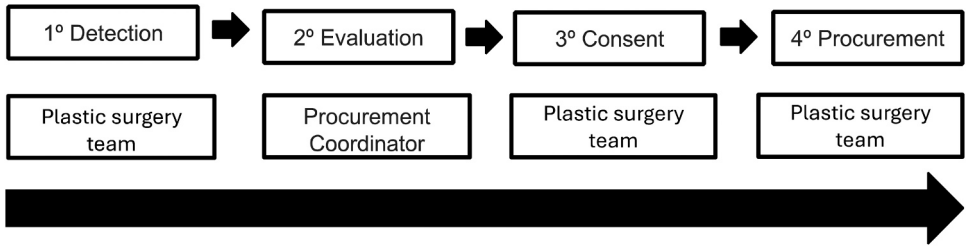

Fig. 2. Skin donation model in living donors.

Table 1
Skin donation in Chile, 2017–2019 triennium.

Year	Cadaveric model		Living donor model		Total	
	Donors	Surface	Donors	Surface	Donors	Surface
2017	1	3.051 cm2	0	0	1	3.051 cm2
2018	1	1.069 cm2	0	0	1	1.069 cm2
2019	2	6.839 cm2	0	0	2	6.839 cm2
Total	4	10.959 cm2	0	0	4	10.959 cm2

7. Comparison of models

Cadaveric models of skin donation are widely established in countries with consolidated tissue donation and transplantation systems. However, in response to the challenges associated with the limited availability of cadaveric skin, a complementary model has emerged based on living donors, specifically patients undergoing body contour surgeries, in which surgical waste is transformed into a source of SA [21,22]. A comparison of these two models allows us to understand their advantages, limitations, and areas of opportunity.

a. Donation time

Cadaveric donor: Historically, candidates for skin donation have been a) patients with brain death in the context of multi-organ donation, where skin procurement usually occurs at the end of the process, and more recently, b) patients with cardiac arrest, whose bodies are preserved at low temperatures and procurement is done during the pathological anatomy process, always within 12 hours of death [23,24].

ii. Living donor: Candidates for living skin donation must fulfill the condition of having large amounts of skin available for resection due to their surgery. Two examples of this situation are abdominoplasty and breast reduction, both for aesthetic and/or reconstructive issues [11,13,14].

b. Informed consent

i. Cadaveric donor: Despite the type of consent for organ and tissue donation (presumptive or explicit) established in each country, the family is always called upon to make the final donation decision. World statistics reflect that only 85 % of potential donors' relatives are interviewed, finally obtaining consent from only 47 % of them. The leading causes of donor rejection are respected, but constitute an important unjustified obstacle for donation, such as a) denial from the family of brain death diagnosis, b) distrust in the health care system, and c) ignorance of donor will while alive [25,26].

ii. Living donor: The tissue donation questionnaire is directly requested from the patient before body contour surgery. In this context, two alternatives are proposed for surgical waste: a) usual, which is elimination, and b) clinical use as SA, indicating that this decision does not change surgical behavior.

c. Feelings associated with donation

i. Cadaveric donor: There is usually an atmosphere of sadness owing to the loss of a loved one, which is partially mitigated through the concept of legacy and transcendence provided by the donation of organs and tissues [27,28].

ii. Living donor: Generally, there are feelings of joy and hope for desired and often expected body changes. Plastic surgery remains a

Table 2
Skin donation in Chile, 2022–2024 triennium.

Year	Cadaveric model		Living donor model		Total	
	Donors	Surface	Donors	Surface	Donors	Surface
2022	0	0 cm2	64	20.652 cm2	64	20.652 cm2
2023	1	5.777 cm2	152	47.409 cm2	153	53.186 cm2
2024	4	15.811 cm2	132	63.936 cm2	136	79.747 cm2
Total	5	21.588 cm2	348	131.997 cm2	353	153.585 cm2

taboo in some countries. From this perspective, skin donation confers a sense of solidarity to this kind of surgery. The phrase "what I had left saved another person's life" is heard repeatedly from these patients, transforming them into ambassadors of the donation process.

d. Skin donation myths

i. Cadaveric donor: The central myth is the body disfigurement that causes skin procurement. However, current protocols guarantee respect for decedent appearance because the areas sought are not exposed (for example, dorsum and posterior surface of lower extremities) and the procedure is performed with a dermatome, extracting epidermis and variable parts of the dermis, which does not produce significant distortions in appearance [29,30].

ii. Living donor: With body contour surgery, donor's body is "remodel"; so, we went from the myth of disfigurement to the concept of beauty restoration.

e. Exclusion criteria

i. Cadaveric donor: Many diagnoses that constitute the cause of death contraindicate organ and tissue donation (e.g., severe sepsis, renal failure, intoxication, hepatic failure). Furthermore, many of these patients have remained in intensive care units for prolonged periods, increasing the probability of skin colonization by pathogenic intrahospital highly resistant microorganisms and contraindicating the clinical use of SA [31–33].

ii. Living donors: Although the inclusion and exclusion criteria are the same for cadaveric and living donors, patients undergoing elective surgeries generally lack many of the contraindications present in cadaveric donors. In addition, the skin of these patients is usually colonized only by commensal microorganisms, significantly reducing the risk of microbial contamination compared with skin from deceased donors.

f. Need for specialized team

i. Cadaveric donor: The extraction of organs and tissues from the decedent follows a logical and orderly sequence, in which the skin goes at the end of the process, usually only before the musculoskeletal tissue, and there is a specific procurement team for each tissue [34,35].

ii. Living donor: Extraction of the dermo fat flap is a central part of body contouring surgeries performed by surgical teams. Therefore, a procurement team is unnecessary, and the only coordination needed is to have a team that brings the supplies needed for temporary storage of the skin and coordinate transportation to the respective tissue bank.

g. Schedules

i. Cadaveric donor: Donation timing is variable, which adds to the fact that the procurement team must wait from the procurement of all the different organs and tissues that precede skin [36].

ii. Living donor: Procurement date and time are scheduled in advance and are considerably less.

h. Product

i. Cadaveric donor: Although it is true that skin can be procured as full-thickness skin grafts from a cadaver, in Chile, only the procurement of split-thickness skin grafts is permitted, for which a dermatome is used. [17].

ii. Living donor: Once the dermo fat flap is obtained, you can: a) uses the dermatome can be used to obtain partial skin grafts or b) Degrease the flap can be degreased using scissors to obtain total skin grafts [11].

i. Main uses

i. Cadaveric donor: Because partial skin grafts are obtained, the main use is in patients with large burns. Thus, they are used in highly complex centers [37,38].

ii. Living donor: Because whole skin sheets are obtained, their primary use is wider. It can be used in patients with complex wounds, such as those exposed to noble structures, such as bone, cartilage, blood vessels, and nerves. Thus, they can be used in medium- and low-complexity centers, such as primary health care.

j. Procured surface

i. Cadaveric donor: the back and posterior surfaces of the lower extremities are usually obtained. Most publications discuss an average of 2000–3000 cm2 of skin procured [31,39,40].

ii. Living donor: The average surface area of the abdominoplasty was 300 cm2. However, body contouring surgeries in post-bariatric patients provide up to 4500 cm2. [41]

k. Donation growth

i. Cadaveric donor: Increasing the rate of skin donation depends on cultural changes that promote awareness and social acceptance of the practice. Unfortunately, changes related to deeply held values and beliefs often require decades to consolidate effectively [42,43].

ii. Living donor: The increase in skin donation depends mainly on adequate inter-institutional coordination to integrate new plastic surgery centers, transforming them into tissue-generating centers.

l. Skin Bank Location

i. Cadaveric donor: Although the situation varies across different countries, most skin banks are located near or linked to burn centers. Therefore, these banks are focused on consumption [44].

ii. Living donor: Its central core comprises tissue generation centers, hospitals, or clinics, which have a high volume of plastic surgeries. Therefore, these are banks that focus on production. A comparison of the donation models is summarized in (Table 3).

8. Discussion

The skin donation model based on the use of surgical waste from body contouring surgeries provides a series of benefits, some of which were mentioned when comparing it with the cadaveric model. However, from a conceptual and practical point of view, there are four fundamental contributions:

a. Increased availability and expansion of therapeutic indications for skin allografts: The surface area of skin procured during the second triennium (2022–2024) was 14 times greater than in the first (2017–2019), mainly due to the implementation of the living donor model, as the number of cadaveric donors remained similar between the two periods. Traditionally, SA have been used primarily in patients with extensive burns. However, the significant increase in availability has enabled their application in a broader range of clinical contexts, including diabetic foot ulcers, chronic wounds, vascular ulcers, soft tissue defects following oncologic resections, and wounds with exposure of critical structures such as bone, cartilage, nerves, and blood vessels.

Table 3
Summary comparison of cadaveric donor and living donor skin donation models.

Donor type	Cadaveric donor	Living donor
Donation moment	Multi-organ donation Donation during anatomopathological examination	Body contouring surgery Surgical waste
Informed consent	Usually family	Patient directly
Feelings	Sadness over the loss of a loved one	Joy for an expected body change
Myths	Body disfigurement	Body refiguration
Exclusion criteria	Multiple	Patients undergoing this type of surgery lack exclusion criteria.
Need for a procurement team	Yes	No. The flap is delivered and deposited in a container with antibiotics. Then transferred to the tissue bank
Schedules	Variables	Previously established
Product	Partial skin	Partial skin and total skin
Main clinical uses	Burns High complexity centers	Complex wounds Low complexity centers
Surface	2500–3500 cm2	300–4500 cm2
Donation growth	Depends on cultural changes	It depends on coordinating logistics with tissue generating centers
Model	Based on need	Based on consume
Location	Associated with burn centers	Associated with plastic surgery centers

Their use can be tailored to different therapeutic goals: a. As temporary coverage, especially in major burn patients; b. As an intermediate solution, where the dermal component integrates into the recipient bed and is later completed with an autograft; c. Or as a definitive coverage, functioning as a dermal regenerative matrix. In the latter case, the permanence of the graft is not due to immune tolerance or prolonged stability, but rather to its ability to stimulate regenerative mechanisms that support complete wound closure and dermal reconstruction. Particularly in major burn patients—historically the primary recipients of SA—advances in critical care and wound management have significantly improved survival rates. However, these gains are frequently accompanied by functional and aesthetic sequelae, largely attributable to the limited dermal contribution of autografts and second-intention healing. These limitations were the driving force behind the clinical development of dermal regeneration matrices [45]. As Damour famously stated: *"If the epidermis ensures the patient's survival, the dermis determines their quality of life."* [4] Although split-thickness allografts remain the preferred option for covering large surface areas due to their lower metabolic demand and ease of integration, CTSA retain a greater amount of dermis and preserve biological viability, promoting dermal integration, angiogenesis, and neodermis formation [46–49]. Therefore, CTSA are particularly recommended in: a. Stable patients requiring coverage of irregular wound beds or fascial/muscle planes, where dermal support enhances graft take and reduces contour deformities; b. Stable patients with deep burns in functionally and aesthetically critical areas, including joints [50] (Figs. 3 and 4). This approach broadens the therapeutic role of CTSA beyond temporary coverage, consolidating their position as biological scaffolds for regeneration in complex burn wounds.

b. Donation ladder: The low rate of organ and tissue donation in the world, particularly in Chile, makes it necessary to adopt measures using social marketing techniques, which allows "promoting the; acceptance, modification, rejection or abandonment of people voluntary behavior, to help them improve their well-being and that of their society, turning a non-belief into a belief, a belief into an attitude, and an attitude into a value" [51–53]. Currently, the predominant organ and tissue donation models focus on promoting post-mortem donation; therefore, there is a lack of an intermediate step in the donation process, which could facilitate a progressive transition in the adoption of this practice. The donation of the fatty skin flap from a living donor and/or the use of any other surgical waste as a source of allograft conceptually allows us to take an initial step in what we have called the donation ladder (Fig. 3). In this first step, the donor gives something that is left over, in an atmosphere of joy, receiving the social and personal benefits of altruism, and becoming ambassadors of this process in society. It has been proven that when someone coud has the opportunity to meet a person who has been a donor or has received organs and/or tissues from another, it positively predisposes them to donation, so perception of this act starts changing [54]. The second step is the donation of blood and its derivates (which for many people is the only "liquid tissue"), in which something is donated that can be reproduced over time. Therefore, the loss is temporary without major physiological repercussions [55]. In most countries, organ and tissue donation program operate independently of blood and blood products donation program, with no fundamental interrelationship between them, lacking this second step. The steps mentioned above are those that currently exist. The third is donating between living donors, in which an organ or tissue is donated from a living person with their own organ or tissue function maintained. The fourth and final step is the donation of organs and tissues from a cadaver where transcendence is sought and/or found. In this donation ladder, the donor goes from simple and low-risk acts to more complex and transcendent decisions, becoming a representative and promoter of this process, thus strengthening a solid donation culture (Fig. 4).

c. Generation of subproducts and recycling: These concepts are widely applied in various disciplines, contributing to resource optimization, environmental sustainability, waste reduction, and the creation of new products or applications derived from primary processes. In this case, the skin obtained from body contouring surgeries can be considered a subproduct of a primary surgical procedure, in which the initial goal is aesthetic or reconstructive. However, when applying the recycling concept, surgical waste is transformed into a scarce subproduct with a high therapeutic value [56,57].

d. Source of biological scaffolds: Obtaining total skin allografts and cryopreservation allows obtaining tissues with a greater thickness of the dermis and, in turn, viability, which provides a biological scaffold that is colonized by the recipient's cells, forming a neodermis [58]. This dermal regeneration function can be complemented and enhanced in the future, considering the triad of tissue engineering: a. Cells, which are the active components responsible for carrying out the biological processes necessary for tissue regeneration, among which the potential role of mesenchymal stem cells derived from adipose tissue stands out [59,60]. b. Scaffolds: three-dimensional structures that provide physical and biochemical support for the growth and organization of cells [61–63] and c. Growth factors, and biochemical signals regulate cell proliferation, differentiation, and function within the scaffold [64]. Thus, total SA provides a biological scaffold that generates a suitable environment

Fig. 3. Major burn patient with 50 % total body surface area affected by third-degree burns. Left: Eschar excision down to the fascia. Center: Coverage with cryopreserved full-thickness skin allografts. Right: Healing at two weeks, showing complete take of the cryopreserved full-thickness skin allografts.

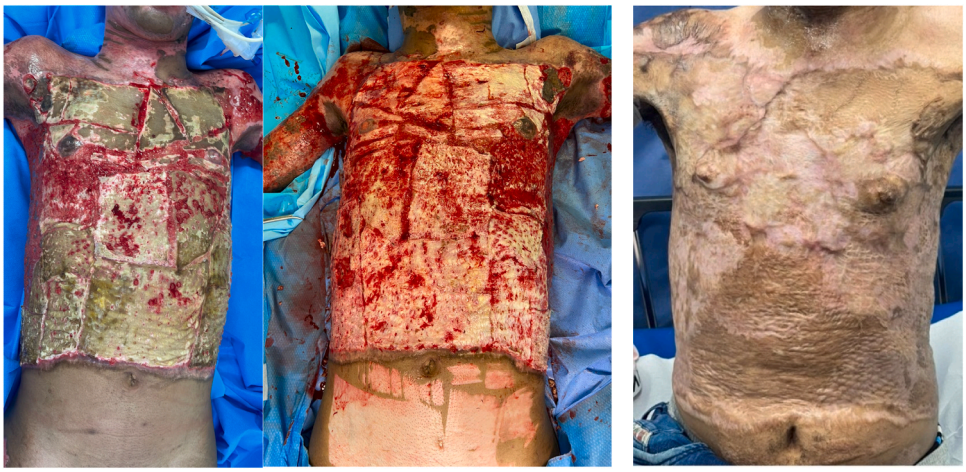

Fig. 4. Left: Healing at 4 weeks. Center: Eschar excision showing a viable wound bed and neodermis formation. Right: Long-term outcome at 6 months following coverage with the Meek technique.

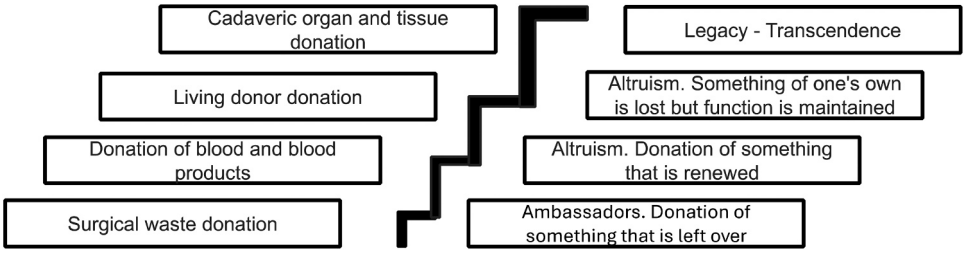

Fig. 5. Donation ladder.

for the recipient cells to colonize this structure and receive instructions through cellular mediators for tissue regeneration. Although acellular dermal matrices (ADM), the classical source of biological scaffolds produced by tissue banks, have traditionally been derived from cadaveric donors, the development of skin donation models based on living donors opens the possibility of producing ADM from surgical residues. The techniques currently used for post-mortem dermis decellularization, such as enzymatic digestion, detergent-based protocols, and mechanical delamination, could potentially be adapted to full-thickness dermal flaps obtained during elective body contouring procedures [19,65].

On the other hand, one of the main objections to the development of the living donor model for obtaining SA is the limited amount of skin obtained per procedure, averaging 0.06 m^2 per living donor, in contrast to the 0.4 m^2 obtained from a cadaveric donor [66]. This difference directly impacts the cost-effectiveness of the model. The most recent publications available in the scientific literature estimate that the cost per square centimeter of cadaveric SA preserved in glycerol ranges between $0.55 and $1 USD, while for cryopreserved cadaveric SA, the cost reaches approximately $1.95 USD [67–69]. If these costs are extrapolated to the smaller amount of tissue available in the living donor model, the final cost per unit of processed skin could be considerably higher. However, the function of cryopreserved total skin allografts as dermal regeneration inducers suggests that their economic assessment should not be limited to a comparison with conventional allograft costs but rather with commercially available dermal regeneration matrices, whose prices are significantly higher [70,71]. In this context, CTSA represent a more accessible and sustainable alternative, particularly for healthcare systems in developing countries, where access to advanced biomaterials remains a critical challenge.

Furthermore, another frequent criticism of this model is that the grafts obtained from a living donor are smaller in size, making them less suitable for covering large affected areas, such as in the case of severe burn patients. However, this characteristic does not represent an absolute disadvantage, as the size of these grafts is optimal for covering complex and localized wounds, such as chronic ulcers, wounds with exposure of noble structures, and burns located in functionally and aesthetically critical areas.

9. Conclusion

The skin donation model from living donors allows us to complement the cadaveric model, having a greater preponderance and being able to be replicated in countries with a low rate of tissue donation. From a clinical perspective, this model facilitates broader access to SA, thereby expanding their therapeutic indications. In this context, CTSA stand out as a simple and effective solution for complex coverage defects, as well as for burn patients requiring reconstruction in functionally and aesthetically sensitive areas, where they contribute to improved functional and aesthetic outcomes. Conceptually, it will allow the creation of a donation ladder, where the donor becomes a promoter of this process, helping society build a resilient and lasting culture of donation–introducing, in turn, the concepts of recycling and generating valuable subproducts. Finally, CTSA can be used as biological scaffolds in regenerative medicine to complement the incorporation of cells and cellular mediators to promote dermal regeneration.

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CRediT authorship contribution statement

Marcelo Fonseca C.: Participated in research design, in the writing of the paper, in the performance of the research, contributed new reagents or analytic tools, and in data analysis. Aldo Cañete S.: Participated in the

performance of the research. Luana Mandriaza M.: Participated in the performance of the research and the writing of the paper. Jennifer Gómez A.: Participated in the performance of the research. Jaume Masiá A.: Participated in data analysis. Katherine Marcelain C.: Participated in data analysis. Dino Ibaceta O.: Participated in the performance of the research. Cristian Erazo C.: Participated in data analysis. Brenda Gámez del M.: Participated in the writing of the paper in data analysis. Carolina Soto D. Participated in the writing of the paper in data analysis. Cristóbal Valdés C. Participated in the performance of the research.

Patient consent statement

Written informed consent was obtained from the patients for the use of the clinical images included in this article. All identifying information has been removed to ensure patient anonymity.

Ethical statement

All procedures and protocols were carried out in accordance with national regulations and under the supervision of the National Coordination for Organ and Tissue Donation and Transplantation of the Chilean Ministry of Health. The study was approved by the Ethics Committee of the Tarapacá Health Service (ACTA SEC SSI Nº 3/2022).

Declaration of Competing Interest

Dr. Marcelo Fonseca Canteros is the inventor of a patent related to the cryopreserved total skin allografts (CTSA) described in this article. The patent was granted in Japan on May 20, 2025, and is under review in other countries. No royalties or financial compensation have been received. The authors declare no commercial bias.

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