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Plastic Surgery

DERMAL REPLACEMENT TEMPLATE WITH SKIN GRAFT: AN ASSET IN THE HEALING OF WOUND REPLACING THE NEED OF FLAPS

Dr. Amber Yadav	Assistant Professor, Department Of Burn And Plastic Surgery, LN Medical College And JK Hospital, Bhopal, Madhya Pradesh, 462001, India
Dr. Sarthak Sharma*	PG -1 Resident, Department Of General Surgery, LN Medical College And JK Hospital, Bhopal, Madhya Pradesh, 462001 *Corresponding Author
Dr. Arun Bhatnagar	Professor, Burn & Plastic Surgery Department Gandhi Medical College, Bhopal, Madhya Pradesh 462001, India.

ABSTRACT **Background:** The standard operating procedure for wound treatment involves the use of flaps. Due to the increased failure rate and complications of flaps in the wound coverage dermal replacement strategies are used. Integra which is two-layered reconstructive template is found to be applicable in wound closure. **Methods:** Total five patients irrespective of their age and sex who were referred to the OPD of Burns and Plastic Surgery, JK hospital and LN Medical College, Bhopal, for flap cover with compound wound over extremities with exposed tendons and/or bone were included in this study. Integra was then used as dermal replacement template for wound coverage treatment. **Results:** Integra was placed after investigating surgical profile of five patients. After two weeks of application, integra dermal replacement template (IDRT) was found to be integrated in tissue and became peach in color. In all the cases the template successfully provided the coverage for the exposed tendons and bones. **Conclusion:** This is a preliminary study to analyze the use of Integra in place of flaps for effective wound healing in limited number of cases. It has shown as an effective in managing burn wounds. Integra provides a sound alternative option for providing durable coverage for the skin and soft tissue loss and should be considered as a part of compound wound coverage algorithm.

KEYWORDS : Integra, skin replacement, bone, tendons, flaps

INTRODUCTION:

The Dermal Regeneration Template has been in commercial use since the 1980s, with its initial description provided by Burke and colleagues in 1981(Frame et al. 2004). Dermal regeneration template integrates at the implantation site and regenerates three-dimensional structure known as neo-dermis in which fibroblasts, lymphocytes, macrophages, and neovascularization is clearly detectable(Agostini et al. 2013; Moiemen et al. 2001, 2011; Papa et al. 2011).

'Integra' is an artificial reconstruction template that finds extensive use in cases of severe injuries, wounds, burns, and other related conditions. In the realm of wound care, the integration of dermal replacement templates with skin grafts stands as a pivotal advancement, revolutionizing the conventional approaches to wound healing (Vithlani et al. 2017). This synergistic technique holds immense promise in addressing complex wounds that traditionally necessitate flap surgeries. Unlike flaps, which involve transferring tissue from one body area to another, this innovative method combines a dermal replacement template with a skin graft, mimicking the natural regenerative process of human skin. By providing a structured foundation for cellular ingrowth, these templates promote the formation of robust, functional tissue(Chalmers, Smock, and Geh 2010).

Integra is composed of two distinctive layers. The outer layer, crafted from silicone, emulates the epidermal layer of the skin. Meanwhile, the inner layer, composed of collagen, plays a crucial role in facilitating tissue regeneration. This collagen is processed into a scaffold known as the CGM (collagen glycosaminoglycan matrices). Combinatorial effect of these two layers makes integra a valuable tool in assisting with wound healing(Taupin, Gandhi, and Saini 2023).

Traditionally challenging wounds, such as those with exposed tendons or deep tissue loss, find a remarkable solution in this approach. Dermal replacement templates, often made of biocompatible materials, not only facilitate tissue regeneration but also significantly enhance the integration and survival of skin grafts. This amalgamation not only obviates the need for extensive flap procedures but also expedites the healing process. In the landscape of wound management, this technique emerges as a transformative asset, offering a more efficient, aesthetically pleasing, and functionally superior alternative to traditional flap surgeries, thereby reshaping the paradigm of wound care and reconstructive surgery.

Applications Of Integra:

Within the field of wound care, the incorporation of dermal replacement templates alongside skin grafts represents a significant advancement, fundamentally changing traditional methods for enhancing wound healing. In the years since its introduction a few decades ago, the application of Integra, has extended beyond its original function in burn reconstruction. Various studies show the supporting evidence of integra as a potential biological template in post-cancer excision surgery, offering a means to reconstruct complex defects(Chang et al. 2019). Lately, negative pressure wound therapy applied with the integra for treating of lower limb injuries with exposed tendons, bone, and nerves(Attia et al. 2020). It is also effective for treatment of blistering and erosions causing syndromes such as 'Carmi syndrome'(Trah et al. 2018). The use of Integra for re-epithelialization has the potential to reduce the complications associated with skin grafts and improves overall aesthetic outcomes(Singer et al. 2015).

Use Of Integra, Both On A Global Scale And Within India:

Wound care treatment has significantly evolved and become highly advanced, particularly in developed nations. Numerous supplementary methods are being employed for treating severe wound healing which includes dermal templates and infused dressings. The changing trend in the field of burn injury management has necessitated the development and utilization of various skin substitutes. In India several studies have been reported for the usage of dermal regenerative template in wound management such as use of Trilaminar dermal regeneration template(Chittoria et al. 2021) and in some cases reported the use of Healicoll template as flap cover for bare bones and tendons(Dhanraj et al. 2016). It is also reported that Acellular dermis also act as matrix for burn treatment(Wainwright and Bury 2011). The utilization of Integra is predominantly documented in the United States, as the company has reported significant sales primarily from this region. Numerous studies have been conducted, establishing its role as a regular line of treatment for the patients. In India numerous studies have been performed showing the efficiency of artificial grafts using the products available in market but there is no study to the best of our knowledge that has been conducted which compares the use of 'Integra' to flaps for managing wounds that are not suitable for direct skin grafting. Hence, in this study we presented five patients case series of patients irrespective of age, treated with 'Integra' as a substitute for flap cover in cases of compound wounds on the extremities with exposed tendons. In this particular context, it appears quite engaging to pursue comparable investigations with larger sample sizes and across various medical scenarios.

Material And Methodology

Study design

This is a prospective case study using Integra as dermal regeneration template for exposed tendons.

Patients:
Total of 5 Patients, 4 male and 1 female who visited OPD Centre of Department of Burns and Plastic Surgery, JK Hospital and LN Medical college, Bhopal for flap cover with compound wound over extremities with exposed tendons and or bone were included in this study. Formal consent was obtained from every patient after approval of the procedure by our institution's ethics committee. The comorbidities include Diabetes mellitus in 3 patients, 2 patients with hypertension and 1 patient with heavy smoking. There were no cases of renal impairment and immunosuppressive diseases. Patients treated with Integra are included in which traditional reconstructive options can be done. This includes patients with defects where using a loco-regional flap would adversely affect the ultimate aesthetic outcome, as well as patients with limited available surrounding skin due to poor skin quality or prior surgical procedures.

Surgical Techniques:
The procedures were performed by the same surgical team, and the choice of anesthesia was determined based on the size and location of the wound, as well as the specific comorbidities of each patient. Following wound debridement, Integra is applied with the cross-linked matrix oriented on the deep surface, for dermal regeneration, while the protective silicone sheet oriented superficially. The material is secured using 5-0 monofilament polyamide sutures, ensuring good template-to-tissue contact circumferentially. Quilting sutures are routinely placed for deep defects to ensure graft adherence. A layer of paraffin gauze and non-adherent dressing bolster is applied and fixed with nylon sutures. Postoperatively, the bolster remains for 1-week and is kept dry. Following bolster removal, the area is cleaned, and mupirocin ointment are reapplied and secured with a tape. This dressing is changed daily. At 3-weeks the silicone sheet is removed and the patient transitions to daily barrier ointment application. The wound is monitored for appropriate epithelialization. Split thickness skin graft (STSG) is necessary and was applied after 3 weeks. The choice to proceed with skin grafting or move forward with an alternative reconstructive technique was solely dictated by clinical judgment; once the granulation tissue completely covered the exposed deep structures, the wound bed was judged amenable to skin grafting. We defined those wounds in which structures unsuitable for direct skin grafting were entirely covered by the granulation tissue, thus allowing for an ideal STSG uptake, as well-vascularized dermal templates.

RESULTS
Integra applied for the patients of variety of wounds. The health Characteristics of Study Participants i.e., patient's characteristics is shown in Table 1, which represents the different comorbidities associated.

Table 1: Health Characteristics Of Study Participants

Variables	Values
Age	24-75
Sex	
Male	4
Female	1
Comorbidities	
Diabetes mellitus	3
Hypertension	2
Heavy smoker	1
Renal impairment	0

Case 1: A 55-year-old male patient with history of Diabetes and Hypertension presented with a diabetic ulcer on left great toe dorsal surface with exposed bone. Debridement of necrotic tissue was performed and Integra bilayer matrix was applied for 21 days. The wound consistently improved and completely healed in a span of 21 days as shown in (Fig. 1 A-D).

Case 2: A 45-year-old man with a history of low-tension electrical burn over right-hand palm region. Debridement of necrotic tissue done and integra bilayer matrix was applied for 21 days. The graft was integrated by 21st day post operative and decrease in the size of wound was observed (Fig. 2 A-D).

Case 3: A 62-year-old man with a medical history of diabetes presented with diabetic ulcer over left foot dorsum of toe debridement. The diabetic ulcer debridement was done followed by the external application of Integra. The graft (Fig. 3A) was integrated by 21st day post operative and decrease in the size of wound was observed (Fig. 3 B-D).

Case 4: A 24-year-old man with documented history of bike accident with severe deformity of foot. Injury resulted in wound formation occurred over dorsum of foot with the exposed tendons. The wound was then covered externally with an Integra patch to the skin. Decrement in the wound size was observed after 21 days (Fig. 4 A-D).

Case 5: A 55-year-old female with complaints of post burn scar over left thigh. The wound was treated with the help of Integra. The time of application of integra grafting was 21 days. Effects after the application of integra includes decrease in wound size. On 21st day of post integra application the wound was successfully healed (Fig. 5 A-C) and no further treatment were applied.

Fig.1 A-D Image showing stages of healing after application of integra over right great toe post traumatic wound.

Fig.2 A-D Integra application over palmar aspect of right-hand post burn and different stages of healing.

Fig.3 A Image showing Integra template; B-D healing stages after integra Application over Rt Great Toe.

Fig.4 A-D Integra Application over dorsum of foot (exposed tendon) pre and post application

Fig.5 A-C Integra Application scar over left thigh post application

DISCUSSION

Addressing deformities in the extremities demands a combination of surgical expertise and sound clinical judgment. Additionally, the presence of exposed bones, joints, and tendons, it significantly intensifies the intricacy of the situation, thereby posing a notable challenge. The use of dermal regeneration template over the exposed tendon promotes the development of granulation tissue which generally fails to support the application of autografts majorly due to issues with tissue mobility. Hence the dermal regeneration template provides advantage as it is applied directly over the exposed tendons and provide immediate closure of wounds. It offers the advantage of avoiding any potential issues related to the allografts such as rejection and contamination. Hence, they are widely applied for managing wounds and to stimulate the healing process. Correct knowledge of complications and those factors are mandatory to optimize a successful reconstruction using dermal substitutes. Common complications of dermal substitutes are infection, hematoma, graft failure, need for multiple procedures or unpredictable matrix thinning with unpleasant aesthetic results in challenging facial defects. Integra as a template have potential to replace flaps as it provides tensile strength and reduces pain significantly. Although the cost plays a crucial role in using it as first line of defense for wound healing. If Integra were to be included in the Aayushman Bharat packages for the Indian population, then it would be mutually beneficial for both patients and doctors. By this approach the patients can access to an advanced wound treatment option with improving outcomes, while doctors would be able to offer a more effective and innovative solution for managing wound cases.

REFERENCES

1. Agostini, Tommaso, Mario Dini, Alessandro Quattrini Li, Luca Grassetti, Andrea Mori, Giuseppe Spinelli, Giulia Lo Russo, and Davide Lazzeri. 2013. "A Novel Combined Surgical Approach to Head and Neck Dermatofibrosarcoma Protuberans." Journal of Cranio-Maxillofacial Surgery 41(7):681–85. doi: 10.1016/j.jcms.2013.01.009.
2. Attia, Attia, Tarek Elmenoufy, Tarek Atta, Ahmed Harfoush, and Sayed Tarek. 2020. "Combination of Negative Pressure Wound Therapy (NPWT) and Integra Dermal Regeneration Template (IDRT) in the Lower Extremity Wound; Our Experience with 4 Cases." JPRAS Open 24:32–39. doi: 10.1016/j.jpra.2020.03.004.
3. Chalmers, R. L., E. Smock, and J. L. C. Geh. 2010. "Experience of Integra® in Cancer Reconstructive Surgery." Journal of Plastic, Reconstructive & Aesthetic Surgery 63(12):2081–90. doi: 10.1016/j.bjps.2010.02.025.
4. Chang, Daniel K., Matthew R. Louis, Alejandro Gimenez, and Edward M. Reece. 2019. "The Basics of Integra Dermal Regeneration Template and Its Expanding Clinical Applications." Seminars in Plastic Surgery 33(03):185–89. doi: 10.1055/s-0039-1693401.
5. Chittoria, Ravi Kumar, Neljo Thomas, Padmalakshmi Bharathi Mohan, Shijina Koliyath, Imran Pathan, and Nishad Kerakkada. 2021. "Role of Allo-Trilaminar Dermal Regenerative Template in Management of Burns." IP Indian Journal of Anatomy and Surgery of Head, Neck and Brain 7(3):88–90. doi: 10.18231/j.ijashnb.2021.023.
6. Dhanraj, Prema, N. Naveen, KRamesh Babu, MS Mahesh, and KS Hanumanthaiah. 2016. "Healicoll: An Alternate to Flap Cover for Bare Bones and Tendons." Acta Medica International 3(1):146. doi: 10.5530/ami.2016.1.30.
7. Frame, James D., Joseph Still, Anne Lakhel-LeCoadou, Michael H. Carstens, Christian Lorenz, Hermann Orlet, Robert Spence, Alfred C. Berger, Eric Dantzer, and Andrew Burd. 2004. "Use of Dermal Regeneration Template in Contracture Release Procedures: A Multicenter Evaluation." Plastic and Reconstructive Surgery 113(5):1330–38. doi: 10.1097/01.PRS.0000111883.93604.85.
8. Moiemen, Naiem S., Jonathan J. Staiano, Nkemcho O. Ojeh, Yi Thway, and James D. Frame. 2001. "Reconstructive Surgery with a Dermal Regeneration Template: Clinical and Histologic Study." Plastic and Reconstructive Surgery 108(1):93–103. doi: 10.1097/00006534-200107000-00015.
9. Moiemen, Naiem, Jeremy Yarrow, Elaine Hodgson, Jiannis Constantinides, Elizabeth Chipp, H. Oakley, Elizabeth Shale, and Martin Freeth. 2011. "Long-Term Clinical and Histological Analysis of Integra Dermal Regeneration Template." Plastic and Reconstructive Surgery 127(3):1149–54. doi: 10.1097/PRS.0b013e31820436e3.
10. Papa, Giovanni, Martina Pangos, Nadia Renzi, Vittorio Ramella, Nicola Panizzo, and ArneŽ Zoran Marij. 2011. "Five Years of Experience Using a Dermal Substitute: Indications, Histologic Studies, and First Results Using a New Single-Layer Tool." Dermatologic Surgery 37(11):1631–37. doi: 10.1111/j.1524-4725.2011.02156.x.
11. Singer, Michael, Jessica Korsh, William Predun, Dennis Warfield, Richard Huynh, Thomas Davenport, and Louis Riina. 2015. "A Novel Use of Integra™ Bilayer Matrix Wound Dressing on a Pediatric Scalp Avulsion: A Case Report." Eplasty 15:e8.
12. Taupin, Philippe, Ankur Gandhi, and Sunil Saini. 2023. "Integra® Dermal Regeneration Template: From Design to Clinical Use." Cureus. doi: 10.7759/cureus.38608.
13. Trah, Julian, Christina Has, Ingrid Hausser, Heinz Kutzner, Konrad Reinshagen, and Ingo Könige. 2018. "Integra®-Dermal Regeneration Template and Split-Thickness Skin Grafting: A Therapy Approach to Correct Aplasia Cutis Congenita and Epidermolysis Bullosa in Carmi Syndrome." Dermatology and Therapy 8(2):313–21. doi: 10.1007/s13555-018-0237-2.
14. Vithlani, G., P. Santos Jorge, E. Brizman, and K. Mitsimponas. 2017. "Integra ® as a Single-Stage Dermal Regeneration Template in Reconstruction of Large Defects of the Scalp." British Journal of Oral and Maxillofacial Surgery 55(8):844–46. doi: 10.1016/j.bjoms.2017.08.006.
15. Wainwright, D. J., and S. B. Bury. 2011. "Acellular Dermal Matrix in the Management of the Burn Patient." Aesthetic Surgery Journal 31(7 Supplement):13S-23S. doi: 10.1177/1090820X11418202.