

## Research Article

### Use Of Integra with Split Thickness Skin Graft in Recurrent Post Burn Neck Contracture: Our Experience

Faraz Ahmad Tarar,<sup>1</sup> Farrukh Aslam Khalid,<sup>2</sup> Abdul Malik Mujahid,<sup>3</sup> ZainUlAbidin,<sup>4</sup> Amin Yousaf,<sup>5</sup> Moazzam Nazeer Tarar<sup>6</sup>

<sup>1-6</sup>Jinnah Burn & Reconstructive Surgery Center, Lahore

#### Abstract

**Objective:** To determine the frequency of successful application of Integra™ and split thickness skin graft in recurrent post-burn neck contracture.

**Methodology:** After informed consent and approval from the ethical board, this descriptive case series was held at Jinnah burn and reconstructive surgery center, from 1st July 2019 to 31st June 2020. Non-probability consecutive sampling was employed and a sample size of 30 cases was included. After release of contracture and excision of scar tissue, Integra™ was applied topped by a silicone gel sheet. The wound was inspected every 3-5 days. A thin split-thickness skin graft was applied after 3 weeks to replace the silicone gel sheet. Patients were followed up for Integra™ and STSG take. Data was analyzed with SPSS 20. For quantitative variables, means and standard deviations were observed. Frequency & percentages were employed to assess qualitative variables. Chi-square test was used and a P-value of <0.05 was taken as significant.

**Results:** The mean age of the patients was 34.51 ± 14.19 years (range 11-59). Out of 30 patients there were 13 (43.33%) male and 17 (57.6%) females. The mean duration of contracture among these patients was 595.42 + 177.31 days with the minimum duration being 225 days and the maximum 1003 days. Successful outcome in terms of complete vascularization at 3-weeks was observed in 28 (93.3%) of the cases, whereas unsuccessful outcome was detected in 2 (6.7%) of the patients.

**Conclusion:** Integra™ and STSG can be considered as a promising modality in post burn recurrent neck contracture management and reconstructive surgery with the significantly high success rate in terms of complete vascularization and graft take.

**Received** | 23-01-2020: **Accepted** | 27-12-2020

**Corresponding Author** | Dr Faraz Ahmed Tarar, Senior Registrar, Jinnah Burn & Reconstructive Surgery Center, Lahore

**Email Id** : faraztarar86@gmail.com

**Keywords** | Integra™, split thickness skin graft (STSG), burn, Neck contracture

#### Introduction

Despite advances in the overall management of burn injuries, severe post-burn contractures continue to form a major chunk of reconstructive surgeries in developing countries<sup>1</sup>. The resultant post-burn contractures are often severe, long standing, and with secondary complications. Management of these problems accounts for up to 50% of a general plastic

surgeon's workload.<sup>2</sup> Early excision of a burn wound is now linked to reduced morbidity and mortality in the burn patient.<sup>3</sup> Early and adequate coverage after excision minimizes the vicious metabolic catastrophic cycle consequent to a large uncovered wound and preempts infection.<sup>4</sup>

Artificial skin has been the holy grail for burn surgeon over the past 30 years. A major step in this direction

has been Integra™ which provides the dermal component of skin lost in deeper burns.<sup>5</sup> Integra was devised by Buke and Yannas in 1981 and it comprises 2 layers; an acellular dermal substitute and a silicone sheet that is removed once the dermal layer has integrated into the native tissue<sup>6</sup> (Figure 1). The dermal layer is composed of cross-linked bovine tendon collagen (collagen type I) and shark chondroitin-6-sulfate.<sup>7</sup> In a study by Lohana et al, success of Integra in terms of graft take in post-burn neck contracture was seen in 87% patients.<sup>8</sup>



**Figure 1:** *a) Integra Pack and b) Opened Pack Showing Bi-Laminar Layered Integra*

There are no local studies that have assessed the results of use of Integra with split thickness skin graft in recurrent post-burn neck contracture. So, the rationale of our study was to determine the outcome of Integra and split thickness skin graft in recurrent post-burn neck contractures. The result of this study will not only modify the treatment of this problem but also help set baseline data both at national and international level.

**Methodology**

This study was carried out at the Jinnah Burn & Reconstructive Surgery center, Lahore, over a period of 1 year from 1<sup>st</sup> July 2019 to 31<sup>st</sup> June 2020. All patients presenting with post-burn neck contractures were included. Non-probability consecutive sampling was employed until target sample size was achieved. Patients with uncontrolled comorbid conditions such as diabetes, hypertension and ischemic heart disease were excluded.

All patients underwent standard pre-operative preparation, and similar surgical procedures, with release of neck contracture and excision of scar tissue, and application of Integra. The patients were inspected every 3 to 5 days until 3 weeks, at which time, the outer silicon layer was removed and thin split thickness skin graft applied. The skin graft was attached with staples. Suf-ratlulle dressing, absorbent gauze and crepe bandage

were used as dressing. All the patients were followed up regularly by the researcher and outcome in terms of graft take was recorded on the 10<sup>th</sup> post-operative day. Graft take of 80% was labelled as successful.

Data was analyzed by SPSS 20. The means and Standard deviations were recorded for quantitative variables, whereas frequency & percentages were employed for qualitative variables. Chi-square test was used and a P-value <0.05 was considered significant.

**Results**

A total of 30 patients were included who underwent Integra and split thickness skin graft. The mean age of the patients was 34.51 ± 14.19 years of which the minimum age was 11 year and maximum of 59 years. Of these 30 patients there were 13 (43.33%) male and 17 (57.6%) females.

The mean duration of contracture among these patients was noticed to be 595.42+177.31 days with the minimum duration being 225 days and the maximum 1003 days. Among these 30 post-burn neck contracture patients successful outcome in terms of complete vascularization after 3-weeks of follow-up was observed in 28 (93.3%) of the cases, whereas unsuccessful outcome was detected in 2 (6.7%) of the patients. Graft take in patients with successful Integra vascularization was 95%. Figure 2 shows the pre-operative, per-operative & post-operative pictures of a representative case.



**Figure 2:** *(a) Pre-op Front View (b) Pre-op Side view (c) Excision of Scar Contracture (d) Application of Integra (e) 3 Weeks Post-op after Removal of Silicone Layer from Integra (f) STSG Application Over Vascularized Integra*



(g) 3 Months Post-op front View (h) 3 months Post-Op side View

### Discussion

It is not uncommon for hypertrophic scars and contractures to form in deeper burns especially in areas of mobility like the neck and axilla. In developing countries where there is insufficient patient compliance and rehabilitation facilities such morbidities are frequent. In addition, scar morbidity is of higher significance in visible areas where camouflage with clothing is less likely for example the head and the neck.<sup>9</sup>

Progress in surgical and medical care have improved the mortality and outcome of complex burn injuries. A greater acumen and knowledge regarding the pathophysiology following burn injuries is a contributing factor, apart from better and holistic care of the burn patient in the recent years.<sup>6,9</sup> Skin substitutes produced by bioengineering that serve as dermal replacements with temporary epidermal components have revolutionized early burn wound coverage in deeper burns.<sup>10</sup> They have made possible early excision of burn wounds and coverage, preventing most post burn sequelae as coverage of burns exceeding 40% TBSA was earlier impossible due to limitations in the amount of graft that could be harvested. Burke et al reported successful coverage of burn wounds of up to 60% with of Integra™ in 10 patients.<sup>6</sup> Integra is now a well incorporated and effective wound coverage solution both for burns and other open wounds, tumor excision wounds and after contracture release.<sup>11</sup>

Weigert et al. reported the successful use of Integra™ for covering severe hand wounds with acceptable outcomes.<sup>12</sup> Integra™ has also been proven to successfully cover exposed skull after burns and cancer excision. For complex scalp wound defect, Komorowska et al have reported a successful take of graft after Integra application in 6 out of 7 cases.<sup>13</sup> Similarly, Faulhaber

et al published the successful use of Integra in 19 patients who presented with post-tumor resection scalp defects<sup>14</sup>. However, multiple small ulcerations with partial necrosis were observed in 1 case with a co-morbidity of renal failure 29 months after the procedure.

We found significantly high percentage of successful outcome of Integra and split thickness skin graft in terms of complete vascularization i.e.93.3% and Integra was unsuccessful in 6.7% of the cases. Lohan et al also reported the use of Integra in coverage of acute and secondary burn reconstruction.<sup>8</sup> Integra™ was used on 37 anatomical sites. Common sites of application were the upper limb 17 cases (45%), torso 13 (36%), lower limb 6 (16%) and head and neck 1 (3%). Integra was successfully used to cover a total of 64% total body surface area. Twenty three patients underwent second-stage skin grafting. The mean time from Integra to grafting was 23 days (with a range of 7- 55 days) and mean graft take was 87% (with a range of 75-100%).

Likewise Seo et al reported their results on the use of artificial dermis & STSG after excision of burn scars. STSG using artificial dermis was performed 11.6 months after burn injuries on average. The mean take rate was 95.9% (range, 74%-100%) in their study results.<sup>9</sup>

Hunt JA also illustrated better cosmesis after neck contracture release with Integra coverage. The mean take of graft with Integra was 90% (range =70-100%) whereas it was only 85% with an epidermal graft.<sup>15</sup>

Histologically, there is total replacement of the host dermis with Integra. There is remarkable differentiation of the papillary and reticular dermis with Integra that is similar to normal skin. For Integra take and dermal incorporation, the four phases observed are imbibition, fibroblast migration, neovascularization, remodeling, and maturation with the neo-collagen having a similar anatomical disposition to that in normal skin. Full incorporation is observed within a span of 2-4 weeks.

### Conclusion

In our study we found that Integra™ and STSG can be considered as a promising modality in post-burn recurrent neck contracture management and reconstructive surgery with the significantly high success rate in terms of complete vascularization and graft take.

### References

1. Saaq M, Zaib S, Ahmad S. The menace of post-burn contractures: a developing country's perspective. Ann



- Burns Fire Disasters. 2012;25(3):152–58.
2. Goel A, Shrivastava P. Post-burn scars and scar contractures. *Indian J Plast Surg*. 2010; 43:63–71.
3. Makboul M, El-Oteify M. Classification of post-burn contracture neck. *Indian J Burns*. 2013; 21:50–4.
4. Mathur R, Jain PK, Chakotiya PS, Rathore P. Anaesthetic and airway management of a post-burn contracture neck patient with microstomia and distorted nasal anatomy. *Indian J Anaesth*. 2014; 58:210–3.
5. Cuadra A, Correa G, Roa R, Pineros JL, Norambuena H, Searle S, et al. Functional results of burned hands treated with Integra(R). *J Plast Reconstr Aesthet Surg*. 2012; 65(2):228–34.
6. Burke JF, Yannas IV, Quinby WC, Bondoe CC, Jung WK. Successful use of a physiologically acceptable artificial skin in the treatment of extensive burn injury. *Ann Surg* 1981; 194: 413–28.
7. VanZuijlen PPM, Gardien KLM, Jaspers MEH, Bos EEJ, Baas DC, van Trier AJM, et al. Tissue engineering in burn scar reconstruction. *Burns Trauma*. 2015; 3:18.
8. Lohana P, Hassan S, Watson SB. Integra™ in burns reconstruction: our experience and report of an unusual immunological reaction. *Ann Burns Fire Disasters*. 2014; 27(1):17–21.
9. Seo DK, Kym D, Hur J. Management of neck contractures by single dermal substitutes and skin grafting in extensive burn patients. *Ann Surg Treat Res* 2014; 87(5): 253–259.
10. Fitton AR, Drew P, Dickson WA. The use of a bilaminar artificial skin substitute (Integra) in acute resurfacing of burns: an early experience. *Br J Plast Surg* 2001; 54(3):208–12.
11. Chalmers RL, Smock E, Geh JL. Experience of Integra in cancer reconstructive surgery. *J Plast Reconstr Aesthet Surg* 2010; 63: 2081–90.
12. Weigert R, Choughri H, Casoli V. Management of severe hand wounds with Integra(R) dermal regeneration template. *J Hand Surg Eur*. 2011;36(3):185–93.
13. Komorowska-Timek E, Gabriel A, Bennet DC, Miles D, Garberoglio C, Cheng C, Gupta S. Artificial dermis as an alternative for coverage of complex scalp defects following excision of malignant tumors. *Plast Reconstr Surg* 2005 Apr;115(4):1010–7.doi:10.1097/01.prs.0000154210.60284.c6.PMID: 16028466
14. Faulhaber J, Felcht M, Teerling G, Klemke CD, Wagner C, Goerdts S, Koenen W. Long-term results after reconstruction of full-thickness scalp defects with a dermal regeneration template. *J Eur Acad Dermatol Venereol*. 2010 May;24(5):572–7.doi: 10.1111/j.1468-3083.2009.03473.x. Epub 2009 Nov 3.
15. Hunt JA, Moisisidis I, Haertsch P. Initial experience of Integra in the treatment of post-burn anterior cervical neck contracture. *Br J Plast Surg* 2000; 53(Issue 8): 652–685.