Research Article

Outcome of Meek Grafting in Post-Traumatic and Post-Burn Patients

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Abstract

Introduction: The coverage of extensive chronic and post burn wounds is a very common dilemma for the Plastic specialist in the setting of limited donor sites. The Meek technique utilizes widely expanded postage stamp autografts to cover such large areas. This study determined the outcome of micrografting technique in post-traumatic & post burn wounds in terms of percentage of graft take.

Methodology: This descriptive case series was held at Department of Plastic Surgery & Mayo Burn Centre. Non-probability consecutive sampling was employed. The study was carried out between Dec 2019 and June 2020. In patients fulfilling inclusion criteria, Modified Meek grafting was done. Twenty patients with total body surface area >30% were included. The statistics of age, gender, etiology of wound, total area involved and graft take rates were recorded.

Results: The mean age was 28.62 years (range 9 – 60) and the average total body surface area (TBSA) involved of the patients was 37.30% (range 30–60%). The most common mechanism was post-burn, accounting for 82.5%of cases, while post traumatic was the cause in 17.5%.Mean graft take was 86.81% on the 10th post-operative day. Graft take in post-traumatic patients was 91.55% while in post burn patients was 85.81%.

Conclusion: The modified Meek technique can be utilized efficiently for larger areas of wounds where donor sites are minimal. It should be part of reconstructive surgeon's armamentarium of tools in coverage of large wounds.

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Introduction

Trauma is a top ranking cause of injury and death worldwide. In certain traumatic wounds, degloving injuries occur by the avulsion of skin and soft tissue after high energy shearing forces, leading to development of large wounds. These wounds are initially managed with repeated debridements and dressings. Later they are covered with autograft or flap reconstruction.[1] Burns are another leading cause of injury. In the past, due to a lack of understanding of the systemic effects of burn injury, massive burns had very high early mortality. Fortunately, a better understanding of burn pathology has significantly reduced the early mortality of severely burned patients.[2,3] Also, early wound coverage reduces chances of wound infection, contributing to improved morbidity and mortality.

Complete coverage of extensive wounds imposes a big challenge for the reconstructive surgeon.[4] Although the use of split thickness skin graft(STSG) or full thickness skin graft (FTSG) has provided a practical method to address wound closure, the paucity of donor sites is a problem when encountering large wounds.[5] Therefore it became necessary to explore other methods of wound coverage. There is a diversity of suggested mechanisms in literature to overcome this problem including postage-stamp technique,[6] mesh procedure,[7]

intermingled transplantation,[8,9] micro-dot skin grafting[10] and the Meek technique.[11,12]

Meek technique of micro grafting, first introduced in 1958,[13] involves the expansion of the skin autografts up to nine times. CP Meek achieved wound coverage with the use of autografts meshed with a special Meek-Wall dermatome and placed them on pre-folded gauzes in a uniform distribution. When those gauzes were expanded on the wound the gaps between autografts filled up from their margins to provide wound coverage. However, when mesh skin grafting technique was introduced by Tanner in 1964,[14] the Meek technique was overlooked due to its cumbersome method. Mesh grafting requires about the same amount of donor surface area as the wound, and it may prove difficult to achieve coverage in large wounds.

The original Meek technique was modified in 1993,[15] which was first published by Kreis et al, in which they used a special glue spray to hold the wooden corks and autografts (Figures 1 and 2). The second modification was nylon pleats instead of the parachute silk gauzes used originally by Meek in his experience (figure 3). These two additions simplified the technique, acquiring a response more welcoming than the original procedure. Now the technique is being used in many centers.[16]

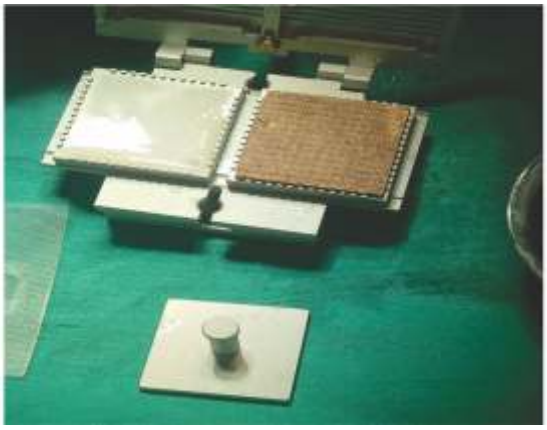

Figure 1: *Carrier Block with Cork Loaded Skin Graft which is Cut in 196 Small Pieces after Passing through the Machine*

The currently available local literature does not provide evidence about the efficacy of graft take with Meek technology. Percentage of graft take varies from 37.5% to 100% with average graft take 74.4% according to a study done by Abelardo Medina et al.[17] Moreover few studies have shown limited data about utility of this technique. Our study will improve the understanding of this technique and add to the body of literature about its use. It will also help the treating surgeon to improve patient outcomes in terms of recovery and lesser morbidity.

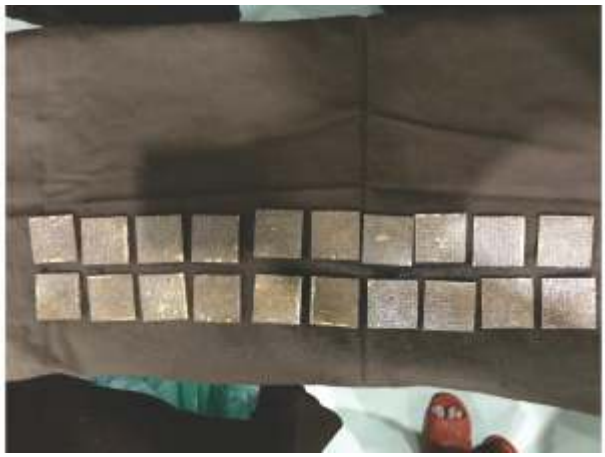

Figure 2: *Corks with Small Autografts after being Sprayed with Glue, Ready to be Transferred Over Prefolded Gauzes*

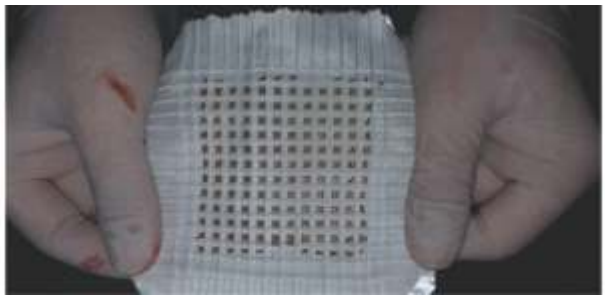

Figure 3: *Gauzes are Expanded and Autografts can be seen Clearly Separated Apart and Ready to Cover the Wound*

Methodology

This descriptive study was held at the Department of Plastic Surgery & Mayo Burn Center from 24-12-2019 to 24 June 2020. A sample size of 20 cases was calculated at 95% confidence level and 12% margin of error considering expected graft take of 37.5% as being successful. Non-probability consecutive sampling was done. Inclusion criteria was patients of either gender, aged between 08-60 years, with post-traumatic and post-burn wounds between 30-50% TBSA. Only wounds that were healthy and granulating were included. Only patients with normal Hemoglobin levels (12-16 gm/dl)& Serum Albumin level (3.5-5.2 gm/dl) were enrolled for the study. Patients who were in Sepsis with WBC value above 15000 and burn patients with inhalational injury were excluded.

All patients underwent standard pre-operative preparation. The procedures were performed under general anesthesia. After performing the graft procedure, the recipient wounds were covered with bactigras dressing, gauze and crepe bandage. First post-operative dressing was changed after 48 hours in the OR, where the outer crepe and gauze were removed and silver sulfadiazene applied over the intact bactigras. Subsequently the dressing was changed after every 48 hours. Skin graft take was assessed on the 10th post-operative day.

Results

In this study there were total 20 cases and the mean age of participants was 28.62 years, with oldest being 60 years and youngest 9 years old. The majority of the patients were male(n=13, 65%), while the remaining 7 (35%) were females.

Post-burn wounds were more common than post traumatic wounds (table 1). The average total body surface area involved was 37.30% and all were deep dermal or full thickness in depth.

Average graft take, observed on day 10, was 86.81%. Commonest reason of graft failure observed was hematoma followed by infection. Graft take percentage in patients with post-traumatic wounds was better (91.55%) than in those with post-burn wounds (85.81%, p value of 0.269). The duration for complete re-epithelialization was approximately 4 to 5 weeks for 1:9 and 3 to 4 weeks for 1:6 expansions.

Figure 4 shows a representative case on 10th post-operative day.

Figure 4: *Post op Day 10,Demonstrating Excellent Graft Take*

Table 1: *Etiology of Wounds*

Cause of wound	Frequency (n)	Percentage (%)
Post-burn	16	80
Post-traumatic	4	20

Discussion

Trauma and burns often result in large wounds requiring coverage, which poses a challenge for the reconstructive surgeons. After initial management as dictated by the cause of injury, these wounds have traditionally been covered by placement of STSG.[18] Traditionally, meshed skin grafting has been the accepted treatment modality to cover these large wounds[(19)] but paucity of donor area is an inhibiting element when harvesting grafts. Micrografting provides an alternative to conventional methods. The studies published before regarding coverage with micrografting techniques were mostly on burn wounds. Coverage of other types of wounds is not much focused in any of previous studies.

Our study analyzed the outcomes of modified Meek technique for coverage of large post-burn and post-traumatic wounds. Our experience suggests that it provides a safe way of achieving wound coverage with expanded autografts in both these types of wounds. It enables a greater expansion ratio as compared to meshed graft[(20)]. The gauzes handle and support the small autografts thoroughly and can be managed more easily than greater expansion ratios (1:6 or 1:9) of mesh skin graft technique.[11]

Kreis et al in 1993 demostrated on 15 patients with post-burn wounds, that modified Meek technique resulted in average graft take rate of 92% at 1 week post-op.[15] Similarly another study done by Lari et al in 2001 included total 7 patients with post-burn wounds. They removed the dressing on third post op day and replaced it with allograft till seventh post-op day in some of their early cases but later they didn't find it necessary to include in their technique as satisfactory results were obtained even without allograft. Their mean graft take was also 90%.[11] The results of both these studies are comparable to our study which showed the average graft take rate of 86.81%.

In another published study by Zermani et al done in 1997, they performed Micrografting technique on five severely burnt patients and found an average graft take rate of about 93% on 6th post-operative day.[21]

A study was done by Hseih et al over a period of 5 years on 37 severely burnt patients involving more than 40% of TBSA. They utilized the Meek technique to cover their wounds and observed a graft take rate of 90-95%. They discussed that complete re-epithelialization was noted in 7– 10 days for

individuals grafted with 1:4 expansions, 2–3 weeks with 1:6 expansions and 1 month with 1:9 expansions.[22] These are also similar to what we observed in our study.

However, Lumenta et al. in 2009 observed only a 70% graft take rate with the Meek grafting method which is less than our results.[12] This difference could be because of the usage of only 1:9 expansion in their patients whereas in our study we utilized a variable ratio depending on the TBSA of patient.

A recent study done in 2016 by Munasinghe et al, conducted Meek Micrografting in eleven patients with post burn wounds and detected 87% graft take. This value is closer to our average graft take rate.[23]

Epithelialization or healing on 10th post op day was a clinical assessment of graft take percentage as done by others.[12,23] We found the graft take percentage was more in trauma patients (91.55%) in comparison with patients who had the etiology of burns (85.81%) which is statistically insignificant. However the number of burn patients were five times more than post traumatic subjects.

In a study by EC Quintero, they stated that patients undergoing Meek technique have less hospital stay than mesh technique. Furthermore the average surgeries per patient are also fewer than the mesh technique.[24]

One reason for relatively rapid epithelialization seen with Meek technique may be that the autografts are distributed in a uniform pattern,[11,20] such that there is a shorter distance between grafts, about 8–9 mm with a maximally expanded 1:9 graft, compared with 11–12 mm in a Tanner meshed graft expanded by 1:6.[22]

While changing the dressing it was sometimes noticed that there was occurrence of infection under the gauze when trying to lift it up. In such circumstances if the gauze could be removed easily we removed it and if it was adherent firmly then we left it there to reduce chances of graft loss with it. While changing the dressing one need to be watchful because there is some possibility of autograft to displace, especially in the first few days. In some data authors have used allografts on 3-6 days of grafting[25] but in our study we didn't use it as Lumenta et al.[11] and Munasinghe et al[23] and found satisfactory results.

There were no statistically significant associations between outcome measures and age. We experienced better graft take of this technique when used on thorax anteriorly and limbs than other parts of the body, similar to what was observed by Alberto Sánchez-García et al.[26]

In our study we observed hematoma and infection were the most common causes of partial graft lost, and similar results were noted by Houschyar et al. and Chua et al.[27,28]

We did not focus on long term results but as previous studies have shown the long term follow up cases we agree that cosmesis is comparable to conventional meshed grafts.[21] The major drawbacks of Meek technique are that it is expensive, needs more staff in operation theatre, and requires increased time as compared to mesh grafting. This has also been demonstrated in previous studies by Almodumeegh et al and Zermani et al.[29,21]

The limitations of this study were that we studied 20 patients over a 6 months period and would recommend larger prospective controlled multicenter trials. Also we did not compare the meek technique with other methods of coverage such as mesh grafting. We also recommend for further research to be aimed at studying long-term results with respect to donor site morbidity and graft aesthetics. Another aspect to study would be the cost-effectiveness of Meek technique as compared to mesh grafting.

Conclusion

The Meek technique efficiently provides coverage to large areas when donor sites are scarce. Although it is labor-extensive, paying attention to the outlined principles allow achieving good results. It should be part of reconstructive surgeon's armamentarium of tools in the coverage of large wounds.

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