

# A critical review of early burn excision and grafting

Early excision and grafting of burn wounds has largely replaced the conservative, non-excisional approach, due mainly to improvements in resuscitation and the introduction of primary tangential excision. A critical review of the literature on the effects of early excision and grafting on mortality and other important patient outcomes, such as infective complications and functional and aesthetic results is presented. A number of variables, such as the exact timing and technique of surgery, the size of the wound, the presence of inhalation injury, and age may all influence the effect of this approach.

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## KEY WORDS

Burn wound  
Early excision and grafting  
Patient outcome  
Surgical technique  
Infection

The overriding principles and aims of surgery for patients with burn wounds are:

- ▶▶ Preservation of life
- ▶▶ Prevention and control of infection
- ▶▶ Conservation of all viable tissue
- ▶▶ Maintenance of function
- ▶▶ Timely closure (Hunt et al, 2000).

Early burn wound excision and grafting (EEG) appears to be able to fulfil these principles. Following the introduction of primary tangential excision (Janzekovic, 1970) and improvements in resuscitation, burn surgeons are being presented with physiologically stable patients 48–72 hours postburn (Press, 1997). This has caused the conservative, non-excisional approach to be largely abandoned in favour of EEG (Hunt et al, 2000).

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The value of EEG cannot be judged only on statistics of patient survival, and indeed the majority of burn injuries are not life-threatening (Press, 1997). Other measures outcome should be used, such as infection, graft failure, number of procedures, functional result and chronic disability, aesthetic result and body image changes, length of hospital stay, and cost of treatment. It is in these areas that EEG has made an obvious clinical difference (Press, 1997).

The advantages and disadvantages of EEG on various aspects of patient outcome will be discussed in this article. The effect is influenced by a number of variables. Due to limitations, the main focus of this article will be on the effect of EEG on outcome measures such as mortality and infection. The omission of well-recognised benefits of EEG such as increased cost-effectiveness (Munster et al, 1994) is acknowledged.

### Mortality

When using EEG, the timing and technique of surgery, burn size, presence of inhalation injury and age may all have a significant effect on mortality (Munster et al, 1994).

### Timing

According to Frye and Luterman (1999) indeterminate wounds should initially be observed and once it becomes evident that spontaneous closure will take longer than three weeks, excision and grafting

should be performed. Wound closure should be accomplished by day 21 post burn (PBD 21) to avoid contracture and scarring and to achieve optimal function and cosmetic results.

It is difficult for even an experienced surgeon to predict whether a burn wound will heal spontaneously in under three weeks because of the 'indeterminate thickness' of a wound (Press, 1997). The superficial appearance of the wound can be deceptive.

In a prospective study of 50 young patients with burns averaging 63.2% total burn surface area (TBSA) (full thickness (FT) 36%), Guo et al (1995) showed that excision and grafting is feasible during the burn shock stage with careful preoperative evaluation and intraoperative cardiovascular monitoring. Full thickness 36% (TBSA) means that 36% of the TBSA involved all (or most) of the dermis. In practical terms, FT is the part of the total burn wound that will not heal on its own within a reasonable period of time and requires grafting. It is usually calculated by clinical assessment at presentation and at first dressing change.

Guo et al (1995) compared immediate excision and grafting (at PBD 1) with delayed excision and grafting at 4–5 days post burn. There was shorter healing time, less blood requirements and less septic complications in the immediate group. However, there

was no randomisation of subjects, no statistical analysis, and the study involved a small number of patients.

### Technique

Burn excision can be tangential (Lloyd and Hight, 1978) or fascial which is usually reserved for very deep burn wounds or for elderly patients (Frye and Luterman, 1999). The idea behind primary tangential excision is the removal of all necrotic tissue and the preservation of all viable tissue to increase the chances of better function and appearance (Brcic and Zdravic, 1979). Meshed split-skin grafting (SSG) is the cover of choice with the advantages over non-meshed being a reduced donor site, a greater chance of survival and better contouring (Kelton, 1999). The main disadvantage is the honeycomb appearance when the wound heals (Richards, 2002). Sheet grafts provide superior cosmetic results (Frye and Luterman, 1999). Full-thickness grafts are used primarily in secondary burn reconstruction.

In an early study of 50 patients treated with tangential excision and grafting and reviewed at 18–38 months, Jackson and Stone (1972) report 'better' scarring with this approach. However, the absence of a detailed description of treatment and assessment protocols, the absence of a control group and a distinction between early and late tangential excision undermine these study results.

### Burn size

Confusion frequently arises with regard to the burn size, patient selection and subgroup formation. For example, if a patient with a 60% scald, with an FT/deep dermal component of 20%, who has 10% excised in the first operation is included in a study of major burns based only on the total burn size there will be better outcome results and misleading conclusions. Total size of burn, size of FT/deep dermal burn and the size of excision, all expressed as a percentage of TBSA, are distinct entities, and should all be reported. Only then can comparison between studies be feasible.

As researchers often study convenience samples, they define small,

moderate and large burns arbitrarily to fit their samples. This makes it difficult to compare studies and draw conclusions about individual patients. Papini (2004) regards major burns to be those greater than 20% TBSA, but this criteria is not necessarily used by other authors.

Excision of a major burn can be total or partial/serial. The most a burn can be excised in one go is 50–60% TBSA as there would be insufficient donor areas for SSG for any greater amount (Richards, 2002). Arturson (1993) places this limit at 70% TBSA. However, larger areas can be excised and the wounds covered temporarily with allograft, xenograft, cultured keratinocytes, skin substitutes (Kelton, 1999) and biological dressings (Frye and Luterman, 1999) until donor site healing allows further definitive cover. Another technique, described by Alexander et al (1981), involving an inner layer of widely meshed autograft and an outer layer of finely meshed allograft may be employed. Study results may be confounded if the technique is not standardised.

### Small

The benefit of EEG on mortality from small burns (<20% TBSA) was recognised in the 1970s (Jougard et al, 1979). Press (1997) highlights a couple of issues. First, small burns that will eventually heal should be excised by experienced surgeons as inadequate excision and grafting will lead to graft loss, adding the size of the donor site to the total wound area, which may result in further surgery. Second, patients with burns that are not life-threatening but who have co-morbidity should not have their wound excised until the associated problems are under control so that the operation does not result in mortality and will have minimal morbidity.

### Large

In a prospective randomised study of 85 patients, 17 to 55 years of age, with burns greater than 30% TBSA (FT greater than 20% TBSA), Herndon et al (1989) compared EEG (within three days post burn) with conservative treatment. They showed that in patients aged 17 to 30 years the EEG group had reduced mortality from burns without inhalation

injury. There was no demonstrable difference in mortality in the 30 to 55 years age group or the patients with inhalation injury. A mortality versus age curve showed increases at the extremities of the age categories. The EEG adult group had a greater number of blood volume turnovers than the conservative group. For the 17 to 30 years age group, which had significantly different results, no breakdown of the distribution of the burn size is given, which weakens the study as burn size is a major indicator of mortality.

### Age of patient

#### Children

In a retrospective study of paediatric burns with an FT/deep dermal component more than 25%, Pietsch et al (1985) compared a group that had EEG within seven days with a conservatively treated group. They showed greater transfusion requirements, a shorter hospital stay, fewer metabolic complications and less burn wound contamination for/in the EEG group. Mortality was also lower but this was not statistically significant. Age and burn size was equally distributed between the two groups. As a retrospective study, there is a potential selection bias. Wound infection is not strictly defined and inhalation injury — a potential confounding factor — is neglected.

#### Elderly

In a retrospective study of 67 burns patients in a single unit who were all aged more than 70 years, Kim and Luce (1998) compared EEG within seven days with conservative management. They reported mortality rates of 57% and 41% respectively ( $p=0.22$ ). They concluded that EEG was of no benefit for older patients with burns and may result in a higher mortality rate. However, the average percentage of TBSA burn was less in the conservative group and FT distribution was not quoted. Co-morbidity, which is another potential confounding factor that is particularly relevant to this population, may not have been equally distributed between the two groups. Another area of potential bias was the selection process. Six out of 73 patients who

died within four days of admission were excluded and all of these patients had been treated conservatively.

### Area affected

Consideration must also be given to the area affected by the burn. The areas examined below contribute relatively little to the TBSA, however, the effect of EEG on these areas may influence the outcome in terms of function, disability, number of reconstructive procedures, aesthetic result and body image.

### Hands

Susceptible to infection and sensitive to impaired blood supply, hands and face are regarded as priority areas (Brcic and Zdravic, 1979). Early excision of burns to the hand provides excellent functional results (Hunt et al, 2000).

In their case series, Wexler et al (1974) performed EEG of hand burns in 18 patients (31 hands). In 15 of these patients, full range of movements was achieved one month after the burn injury with active and passive mobilisation, involving dynamic and static splinting, physiotherapy and occupational therapy.

In a prospective randomised study of 222 hand burns to evaluate if excision and skin grafting had any functional advantage over conservative management, Edstrom et al (1979) showed no significant difference between the two treatment modalities. The use of range of motion exercises and splinting allowed optimal healing and prevented stiffness and contractures in both groups. However, their inclusion criteria were deep partial-thickness burns of the hand that remain unhealed by 14 days, and excision and grafting was not performed earlier than approximately day 14.

In a case series of 60 patients with deep dermal dorsal hand and finger burns who were treated by tangential excision and immediate mesh autografting, Hunt et al (1979) showed 100% graft take in all but four hands; sustained excellent hand function with full range of motion by the 10th postoperative day; no subsequent

surgery for scar revision or contracture release; and good cosmetic appearance except for the early mesh appearance of the graft, which became less apparent with time.

Pegg et al (1984) concluded that EEG of hand burns is safe and practical, and combined with adequate splinting, exercise and pressure garments, gave good results and reduced hospital stay in patients with relatively small injuries.

In their study of 11 paediatric patients who underwent excision and full thickness skin grafting (FTSG) of deep palm burns (12 palms) within two weeks of injury, Pham et al (2001) showed that the procedure can be performed in the outpatient setting, and that these grafts have an acceptable colour match, were minimally raised, and achieved excellent cosmetic result.

### Face and neck

In a study of 16 patients treated with EEG within four days post burn, Jonsson and Dalsgaard (1991) recommended the procedure for selected cases highlighting the potential risks of ectropion and microstomia when operating around the eye and mouth. In another well conducted comparative study of two groups of young adult patients with burns of the anterior cervical region treated with EEG (at PBD 4) or delayed excision and grafting (at PBD 24), Voinchet et al (1995) demonstrated the advantages of EEG with regards to length of hospital stay and complications, such as hypertrophic scarring, scar contracture and adhesions.

In a retrospective study of EEG of face and neck burns Cole et al (2002) presented complete sets of postoperative photographs of 45 patients. In their opinion, the aesthetic results of the procedure allowed patients to return to society and minimised time off work or out of school. Although this contribution from a group with great experience in this approach is invaluable, there is a potential selection bias and the standardisation of photographic conditions cannot be considered

adequate. As expected from a retrospective study there was no control group.

### Perineum and genitalia

Frye and Luterman (1999) recommended good local wound care as the mainstay of treating burn wounds affecting the perineum and genitalia as the area has excellent blood supply and most wounds will heal spontaneously. Also, excision and grafting in this area is technically difficult. On the other hand, in a case report of a patient who sustained severe electrical burns of the genitalia and was treated successfully with EEG, Edelman et al (1991) advocated this procedure highlighting the advantages of preservation of viable tissue and minimising sepsis.

### Inhalation injury

Since the presence of inhalation injury is a well-documented factor that increases mortality, it is crucial to have a control for this in any study that assesses mortality. The decision to undertake early escharectomy in patients with inhalation injury presents a clinical dilemma. EEG is probably warranted in patients with burns who have inhalation injury or chronic obstructive pulmonary disease, if certain conditions are met (Hunt et al, 2000), such as haemodynamic stability, keeping operating room and body temperatures above 37°C, limiting anaesthesia time to two hours and excision of no more than 25% of TBSA at one time.

### Infection

The most common cause of death, increased morbidity and prolonged wound healing is infection of the burn wound, complications of which include septicaemia and pneumonitis (Haynes, 1969). During the past 20 years, the primary cause of death has shifted from invasive burn wound infection to bronchopneumonia (Hunt et al, 2000). Powerful topical antimicrobials introduced 25 years ago changed the epidemiology of burn wound sepsis (Mayhall, 2003) but did not influence survival. Luterman et al (1986) gave an excellent overview of burn sepsis and its control.

Earlier beliefs that EEG can promote sepsis by transferring organisms from the eschar into vascular tissue planes opened by the procedure (Jouglard et al, 1979) have now been abandoned. Most authors agree that EEG reduces infective complication by promptly removing bacterial load. In a prospective study of the effects of EEG on bacterial colonisation and invasion, Barret and Herndon (2003a) compared immediate excision within one day with 'delayed' excision at PBD 7. They found lower bacterial counts in both the excised eschar and the wound bed for the immediate excision group and, most importantly, lower infection, graft loss and sepsis rates. However, the number of patients in the study was small and the average TBSA in the 'delayed' excision group was higher. This was not addressed by the authors and may account, at least partially, for the higher complication rate in the 'delayed' group.

### Scarring

The inherent advantage of EEG with regards to aesthetic outcome is based on the fact that hypertrophic scarring rates increase significantly if healing is delayed from three to six weeks (Papini, 2004). In a prospective randomised trial of moderate burns (defined as less than 30% TBSA) using conservative treatment in the control group, Subrahmanyam (1999) reports superior aesthetic and functional results with EEG (before PBD 6). However, without a detailed description of the assessment protocol of the aesthetic and functional result, a potential bias from the assessors undermines the study results.

### Immune system

Virtually every aspect of the immune system is disturbed by a burn injury. Impairment of both humoral and cell-mediated immunity manifests as depressed levels of immunoglobulin, diminished lymphocyte proliferation and response and reduced activation of complement (Hunt et al, 2000). Suppression of immunity may contribute to the high incidence of sepsis (Cetinkale et al, 1993). Research on the subject involves primarily animal models and the results cannot be easily transferred to people. However, encouraging results

have been reported for the beneficial effect of EEG on neutrophil delivery to inflammatory lesions (Tchervenkov et al, 1988), cellular immunity (Cetinkale et al, 1993), cytotoxic T lymphocyte function (Hultman et al, 1995) and viral-specific T lymphocyte cytotoxicity (Hultman et al, 1997).

### Metabolism

All large burns are associated with hypermetabolism (Hunt et al, 2000). A reduction in wound size by spontaneous re-epithelialisation or by EEG does not appear to attenuate the hypermetabolic response of large burns (Nguyen et al, 1996). One reason for this may be the remaining open wounds in the form of donor sites and non-excised burns, which despite their smaller size compared with the initial burns may be sufficient to perpetuate the hypermetabolic process once established (Demling et al, 1991).

In a prospective controlled study of severely burned patients treated with EEG at 24 hours or at PBD 6, Barret and Herndon (2003b) showed that differences in oxygen consumption were minimal. However, the EEG appears to modulate the inflammatory response, decreasing levels of acute phase proteins and cytokines while preserving levels of anabolic peptides. Weaknesses of the study are the small number of patients included and the fact that the control/late excision group was treated in a different unit for five days before surgery.

### Blood loss

Haemorrhage was identified early as a disadvantage of EEG (Monafo et al, 1972). In a large study of children, Desai et al (1990) showed that a group that had immediate excision (within 24 hours) and a group that had a late excision (after PBD 16) had significantly less blood loss than an early excision group (between two and 16 days). However, most of the blood loss figures vary slightly between abstract, text and tables. Also, the average FT burn size in the late excision group was significantly smaller than in the immediate group, explaining perhaps that there was no demonstrable

difference in blood loss between these two groups. The authors examined the potential influence of various factors in the group with burns that were greater than 30% TBSA with multiple regression analysis. This was appropriate but they did not examine the effect of inhalation injury. Characteristically, there were no inhalation injuries in the immediate group, compared with 25 and 20 in the other two groups.

An important contribution of the study is the development of a predictive formula for blood loss depending on burn size and day of excision. The authors concluded that near-total excision of large burns can be safely performed during the resuscitative phase resulting in less blood replacement without affecting mortality. With early excisions, there exists the potential harm of excising viable tissue. On the other hand, graft take rates are 90–95% if EEG is performed within 48 hours, and significantly decreases after PBD 3. A potential confounding factor is the technique of excision as fascial excision is associated with less blood loss.

### Key Points

- ▶▶ The reduction in mortality rates by EEG is influenced by burn size, presence of inhalation injury, age and timing of surgery.
- ▶▶ EEG appears to have reduced infection rates and improved functional and aesthetic results, length of hospital stay and cost of treatment.
- ▶▶ Studies are weakened by lack of standardisation for confounding factors, such as burn size and excisional technique, and by arbitrary definitions of burn size groups and infection.
- ▶▶ This approach necessitates thoughtful patient selection, careful planning and execution at the appropriate time.



Subrahmanyam (1999) emphasises that non-availability of suitable allogenic blood can be a potential problem, especially in developing countries. The HIV pandemic has worsened the shortage of blood, and the danger of transmitting HIV exists. In addition to tourniquets, adrenaline and fibrin glue, other agents are currently under investigation (Mzezewa et al, 2004).

**Summary**

Benefits of EEG include reduction in mortality rates, a decrease in infective complications and better aesthetic outcome. Timing, patient age, burn size and inhalation injury all have an effect on outcome. This approach necessitates thoughtful patient selection, careful planning and execution at the appropriate time. Blood loss should be considered and can be prohibitive in certain settings. **WUK**

**References**

Alexander JW, MacMillan BG, Law E, Kittur DS (1981) Treatment of severe burns with widely meshed skin autograft and meshed skin allograft overlay. *J Trauma* **21**(6): 433–8

Arturson G (1993) Management of burns. *J Wound Care* **2**(2): 107–12

Barret JP, Herndon DN (2003a) Effects of burn wound excision on bacterial colonization and invasion. *Plast Reconstr Surg* **111**(2): 744–50; 751–2

Barret JP, Herndon DN (2003b) Modulation of inflammatory and catabolic responses in severely burned children by early burn wound excision in the first 24 hours. *Arch Surg* **138**(2): 127–32

Brcic A, Zdravic F (1979) Lessons learnt from 2,409 burn patients operated by early excision. *Scand J Plast Reconstr Surg* **13**(1): 107–9

Cetinkale O, Ulualp KM, Ayan F, Duren M, Cizmecic O, Pusane A (1993) Early wound excision and skin grafting restores cellular immunity after severe burn trauma. *Br J Surg* **80**(10): 1296–8

Chait LA, Esmonde-White MF, Walker DH (1975) The treatment of burns by early tangential excision and skin grafting. *S Afr Med J* **49**(34): 1375–9

Cole JK, Engrav LH, Heimbach DM et al (2002) Early excision and grafting of face and neck burns in patients over 20 years. *Plast Reconstr Surg* **109**(4): 1266–73

Demling RH, Frye E, Read T (1991) Effect of sequential early burn wound excision and closure on postburn oxygen consumption. *Crit Care Med* **19**(7): 861–6

Desai MH, Herndon DN, Broemeling L, Barrow RE, Nichols RJ Jr, Rutan RL (1990)

Early burn wound excision significantly reduces blood loss. *Ann Surg* **211**(6): 753–9; 759–62

Edelman GC, Sweet ME, Messing EM, Helgerson RB (1991) Treatment of severe electrical burns of the genitalia and perineum by early excision and grafting. *Burns* **17**(6): 506–9

Edstrom LE, Robson MC, Macchiaverna JR, Scala AD (1979) Prospective randomized treatments for burned hands: nonoperative vs. operative. Preliminary report. *Scand J Plast Reconstr Surg* **13**(1): 131–5

Frye KE, Luterman A (1999) Thermal burns. In: J Weinzwieg (ed) *Plastic Surgery Secrets*. Hanley & Belfus, Philadelphia

Guo ZR, Sheng CY, Diao L, Gao WY, Yang HM, Lin HY, Han JL (1995) Extensive wound excision in the acute shock stage in patients with major burns. *Burns* **21**(2): 139–42

Haynes BW Jr (1969) Early excision and grafting in third degree burns. *Ann Surg* **169**(5): 736–47

Herndon DN, Barrow RE, Rutan RL et al (1989) A comparison of conservative versus early excision therapies in severely burnt patients. *Ann Surg* **209**: 547–53

Hultman CS, Cairns BA, deSerres S, Frelinger JA, Meyer AA (1995) Early, complete burn wound excision partially restores cytotoxic T lymphocyte function. *Surgery* **118**(2): 421–9; 429–30

Hultman CS, Yamamoto H, deSerres S, Frelinger JA, Meyer AA (1997) Early but not late burn wound excision partially restores viral-specific T lymphocyte cytotoxicity. *J Trauma* **43**(3): 441–7

Hunt JL, Purdue GF, Zbar RIS (2000) Burns: acute burns, burn surgery, and postburn reconstruction. *Select Read Plast Surg* **9**(12): 5–10

Hunt JL, Sato R, Baxter CR (1979) Early tangential excision and immediate mesh autografting of deep dermal hand burns. *Ann Surg* **189**(2): 147–51

Jackson DM, Stone PA (1972) Tangential excision and grafting of burns. The method, and a report of 50 consecutive cases. *Br J Plast Surg* **25**(4): 416–26.

Janzekovic Z (1975) A new concept in the early excision and immediate grafting of burns. *J Trauma* **15**(1): 42–62

Jonsson CE, Dalsgaard CJ (1991) Early excision and skin grafting of selected burns of the face and neck. *Plast Reconstr Surg* **88**(1): 83–92; 93–4

Jouglaud JP, Echinard C, Carlin G, Manelli JC, Palayret D (1979) Severity and prognosis after early excisions from one to twenty percent of the body surface area. *Scand J Plast Reconstr Surg* **13**(1): 121–5

Kelton PL (1999) Skin grafts and skin substitutes. *Select Read Plast Surg* **9**(1): 1–23

Kirn DS, Luce EA (1998) Early excision and grafting versus conservative management of burns in the elderly. *Plast Reconstr Surg* **102**(4): 1013–7

Lloyd JR and Hight DW (1978) Early laminar excision: improved control of burn wound sepsis by partial dermatome debridement. *J Pediatr Surg* **13**(6D): 698–706

Luterman A, Dacso CC, Curreri PW (1986) Infections in burn patients. *Am J Med* **81**(1A): 45–52

Mayhall CG (2003) The epidemiology of burn wound infections: then and now. *Clin Infect Dis* **37**(4): 543–50

Monafo WW, Aulenbacher CE, Pappalardo C (1972) Early tangential excision of the eschars of major burns. *Arch Surg* **104**(4): 503–8

Munster AM, Smith-Meek M, Sharkey P (1994) The effect of early surgical intervention on mortality and cost-effectiveness in burn care, 1978–91. *Burns* **20**(1): 61–4

Mzezewa S, Jonsson K, Aberg M, Sjoberg T, Salemark L (2004) A prospective double blind randomized study comparing the need for blood transfusion with terlipressin or a placebo during early excision and grafting of burns. *Burns* **30**(3): 236–40

Nguyen TT, Gilpin DA, Meyer NA, Herndon DN (1996) Current treatment of severely burned patients. *Ann Surg* **223**(1): 14–25

Papini R (2004) Management of burn injuries of various depths. *Br Med J* **329**(7458): 158–60

Pegg SP, Cavaye D, Fowler D, Jones M (1984) Results of early excision and grafting in hand burns. *Burns Incl Therm Inj* **11**(2): 99–103

Pham TN, Hanley C, Palmieri T, Greenhalgh DG (2001) Results of early excision and full-thickness grafting of deep palm burns in children. *J Burn Care Rehabil* **22**(1): 54–7

Pietsch JB, Netscher DT, Nagaraj HS, Groff DB (1985) Early excision of major burns in children: effect on morbidity and mortality. *J Pediatr Surg* **20**(6): 754–7

Press B (1997) Thermal, electrical, and chemical injuries. In: Aston SJ, Beasley RW, Thorne CHM (eds) (1997) *Grabb and Smith's Plastic Surgery* (5th edn). Lippincott-Raven, Philadelphia

Richards AM (2002) *Key Notes on Plastic Surgery*. Blackwell Science, Oxford

Subrahmanyam M (1999) Early tangential excision and skin grafting of moderate burns is superior to honey dressing: a prospective randomised trial. *Burns* **25**(8): 729–31

Tchervenkov JI, Epstein MD, Silberstein EB, Alexander JW (1988) Early burn wound excision and skin grafting postburn trauma restores in vivo neutrophil delivery to inflammatory lesions. *Arch Surg* **123**(12): 1477–81

Voinchet V, Bardot J, Echinard C, Aubert JP, Magalon G (1995) Advantages of early burn excision and grafting in the treatment of burn injuries of the anterior cervical region. *Burns* **21**(2): 143–6

Wexler MR, Yeschua R, Neuman Z (1974) Early treatment of burns of the dorsum of the hand by tangential excision and skin grafting. *Plast Reconstr Surg* **54**(3): 268–73