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Preputial Skin Grafts

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1. Introduction

Although skin grafting originated 2500 to 3000 years ago, it was until the 19th century that this technique was again introduced as a reconstructive option. While 19th century surgeons used grafts to repair their most difficult cases, skin grafting has since evolved into a modality that is routinely and sometimes preferentially used for the surgical repair of skin defects [1].

In this chapter we will discuss a relatively new type of full thickness skin graft: Preputial skin graft (PSG); regarding its indications, advantages, disadvantages and the valid reasons for the choice of PSG instead of classical full thickness skin graft (FTSG) donor sites for grafting of small defects especially in burned patients.

2. Full thickness skin grafts

A graft is the simplest way to cover superficial skin loss. It consists of the transfer of a section of skin, of variable thickness and size, which is completely detached from its original site and moved to cover the zone to be repaired [2].

Skin grafts can be divided into four types : full thickness grafts, split thickness grafts (STG), composite grafts and cartilage grafts [3]. According to the thickness of the explants, skin grafts are classified as split thickness and full thickness. STGs are further divided into thin (0.15-0.3 mm), intermediate (0.3-0.45 mm) and thick (0.45-0.6 mm). FTSGs are usually thicker than 0.6 mm [1, 2].

The outcome of skin grafts can depend on their thickness. An explant usually takes if it is split thickness, that is includes the epidermis and a small portion of the dermis. If the explant is full thickness, that is, consisting of the entire thickness of epidermis and dermis, it only takes if it is relatively small, so that it can be nourished by peripheral, probably lymphatic, imbibitions [2].

Because of poor acceptance of the resulting scars, STGs are usually reserved for deep and full thickness dermal burns, extensive skin losses in areas other than the face, and where the recipient bed is poorly vascularized, full thickness skin grafts, used to cover small areas, provide solid and fairly elastic material, producing satisfactory scarring results not subject to retraction. They are particularly useful for repair of skin losses on the face and fingers, as an alternative to local flaps [1-4].

Full thickness skin grafts are composed of epidermis and the full thickness of dermis, including adnexial structures such as hair follicles and sweat glands. Full thickness skin grafts are most commonly used to repair defects in face and fingers as an alternative to local flaps. FTSGs can provide excellent color, texture and thickness matches for facial defects, and may be especially useful for the repair of defects of the nasal tip, dorsum, ala, and side wall as well as the lower eyelid and ear [1-3].

Selection of a donor site for a FTSG depends on the color, texture, thickness and sebaceous qualities of the skin surrounding the defect [1, 3]. Most FTSGs are taken above the shoulders, whose color, vascular pattern, texture, thickness and density and distribution of adnexial structures best match the tissue surrounding facial defects [1].

The most frequently used grafts, especially for the dermocosmetic purposes, are thick or intermediate split thickness grafts for the repair of areas greater than 3 cm diameter and full thickness grafts for the repair of smaller areas [1].

3. Preputial skin grafts

In last decade, an extraordinary type of FTSG; PSG has been used as an alternative graft source and has promising results. The use of PSG is not a new idea. Its usage is well described in hypospadias surgery till now [5]. In last two decades choice of PSG as a graft source has been reported for many clinical conditions such as burn, release of contractures, syndactyly repair, eyelid and anal canal reconstruction, intraoral burn reconstruction, closure of defects after nevus excision and penile skin defect repair [6-12]. Most of these reports are single case reports. Its usage in burned patients is described in literature in relatively larger series of patients [13-15]. But PSG is still not used as a routine full thickness graft side among surgeons [13, 14].

Modern treatment of deep partial-thickness and full-thickness burns are operative debridement with subsequent skin graft coverage. Currently, nearly 95 % success rate is the standard of care for skin grafting. For this success, adequate wound bed preparation, careful selection of donor sites, and appropriate perioperative care are critical. From these factors, careful selection of donor sites is important as donor site problems may occur.

In patients with extensive burns, all unburned areas can be used as donor sites. However, in small burns, selection of donor site can be problematic. Since all donor sites scar to some degree, it is advised to take skin from an area that will be otherwise hidden under most circumstances [16].

Preputial skin graft is a full thickness and expandable graft that can be easily harvested and used [13]. The prepuce is very thin, pliable skin. Its major advantages are its relatively large size and, as a full thickness graft, its very low tendency to contract [14]. Also, like the split thickness graft, it has high viability. A thinning procedure, which is required for the harvest of other donor sites, is not required. Additional advantages of PSG are; they do not need donor site care, do not causes scar, donor site is hidden and can be harvested with simple surgical instruments. In small burns, it has the advantage of not to disrupt any healthy skin area for graft harvesting [13, 14] (Figure 1).

In one series of the patients of which all were burned children, PSG has been used liberally. In this report all of the patients were burned children with an average age of 3,6. Preputial skin graft was the only donor site for 25% of patients and average size of PSG was 6 x 4 cm.

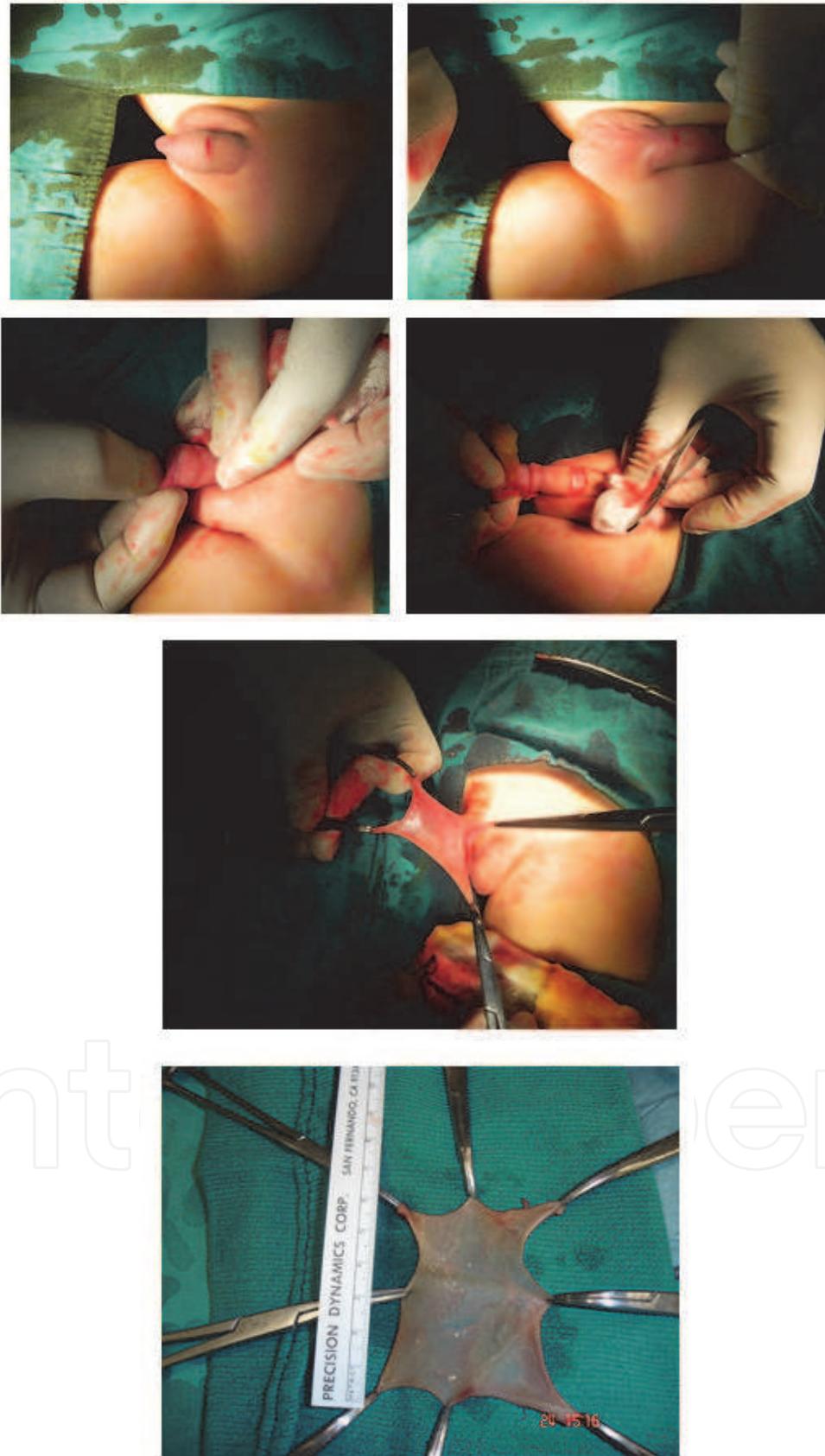


Fig. 1. Circumcision and preparation of skin graft

In 2 patients, PSG was used for periareolar grafting where hyperpigmented healing was preferred (Figure 2). General anesthesia was required in 91% of patients because of need for additional donor sites. Overall graft survival was 100% without any complication of donor site [13] (Table-1). In another series of patients, PSG has been successfully used for burn contracture release, acute burn treatment and for defects in scalp and defects from acute trauma. Mean defect size was 3.5x5.5 cm in this study in which PSG was enough to cover these defects in 90% of the patients. All the recipient area was opened on postoperative day 5. Graft survival was 100 % and no complication on donor site [14] (Table-1).



Fig. 2. Periareolar grafting with preputial skin

	Number of Patients	Mean age of Patients	PSG was the only donor Site (%)	Average Defect Size	Mean PSG Size	Graft Survival (%)	Indication for PSG use	Donor site morbidity (%)
Dogrul et al.	12	3.6	25	N/A	6x4 cm	100	Burn	0
Yıldırım et al.	11	7.9	90,9	3.5x5.5 cm	N/A	100	Burn, contracture release, scalp defect and defects from trauma	0

Table 1. Two series of patients in which PSG was liberally used.

Recently in a study performed by Mcheik and et al, keratinocytes isolated from preputial skin after double enzymatic digestion. They cultured keratinocytes and obtained an average of 8.8 million cells per foreskin. And they concluded that keratinocyte resulting from foreskin have a high capacity of division. These cells can divide a long time before differentiation and enabled them to propose with their patients the keratinocytes from foreskin for wound healing especially for burns in children [17].

Only limitation of PSG is its healing with hyperpigmentation which limits its usage in face and neck region which are the most common recipient side of FTSGs [13, 14]. But it can be used in extremity and scalp defects [14]. But this color mismatch may be an advantage if it is used in special areas like periareolar area [13]. Other limitation of PSG may be potential complications of circumcision.

Circumcision is the surgical procedure for harvesting PSG. As with any surgical procedure, bleeding and infection are probably the most common complications of circumcision [18]. Other complications include hematoma formation, diffuse swelling and pain from inadequate anesthesia and tearing of the sutures due to erection before healing is complete [18]. Urethral injury and penile necrosis are exceptional but reported complications [18]. These complications decrease with experience and can be as low as 0.034 % where circumcision is routinely performed [14].

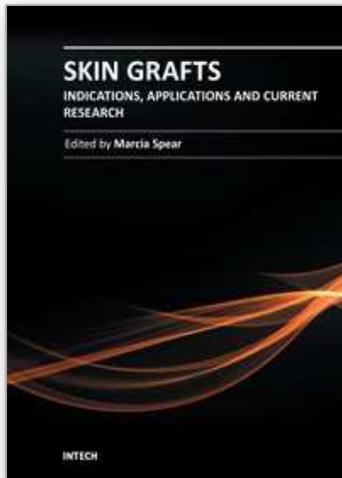
In some countries, circumcision is the most common surgical procedure in boys because of religious and cultural reasons. It is routinely performed to all male children with a very low complication rates [13]. There are also some absolute medical indications for circumcision, such as phimosis secondary to balanitis xerotica, obliterans and recurrent balanoposthitis [19, 20]. Relative indications of circumcision are paraphimosis, phimosis, preputial pearls, redundant foreskin, hypospadias surgery [19]. Besides, it may have some medical benefits such as improved hygiene, reduced risks of urinary and sexually transmitted infections, and of penile and cervical cancer [20]. However, opponents deny or minimize these benefits and put forward complications of circumcision and loss of penile sensation [20]. But we think that; in burn patients, benefits of PSG outweigh from potential complications of circumcision.

Although PSG is still not in routine use in the era of reconstructive surgery, reported series have promising results [13, 14]. Especially in burned children with small sized defects, PSG may be the only graft that adequately used for closure of defects with almost nil donor site complication and 100 % graft survival rate. Only limitation for its usage is hyperpigmentation. Every surgeon must keep PSG in mind as an alternative donor site.

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The procedure of skin grafting has been performed since 3000BC and with the aid of modern technology has evolved through the years. While the development of new techniques and devices has significantly improved the functional as well as the aesthetic results from skin grafting, the fundamentals of skin grafting have remained the same, a healthy vascular granulating wound bed free of infection. Adherence to the recipient bed is the most important factor in skin graft survival and research continues introducing new techniques that promote this process. Biological and synthetic skin substitutes have also provided better treatment options as well as HLA tissue typing and the use of growth factors. Even today, skin grafts remain the most common and least invasive procedure for the closure of soft tissue defects but the quest for perfection continues.

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