Evidence-based and clinical views on acute wound healing and scar formation
Bröllmann, Fleur

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Chapter 1

General introduction and outline of this thesis
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Clinical scenario

A 43-year-old woman, bitten on her calf by a dog, consults her general practitioner (GP). The GP provides the standard local wound care according to the national recommendations for GPs, leaving the wound open after disinfection. The GP decides not to prescribe prophylactic antibiotics as the wound is located on the leg. After a week, the woman returns to her GP with a fever. The affected leg is painful, swollen and red, and the wound size has increased over time. The GP refers the patient to hospital, fearing the need for extensive debridement.

In the local hospital the wound is cleansed with saline solution in the emergency department. During the patient's hospital stay, a culture swab is taken of the wound before the patient is administered systemic antibiotics and a general surgeon performs sharp wound debridement. After several days, the infection has been successfully eliminated and a superficial granulating wound remains. The surgeon, however, considers the chances of a recurrence of infection to be too high to let the wound heal by secondary intention. The surgeon explains to the patient that he would prefer to encourage primary wound closure by means of a skin transplant. Although the patient wonders whether the donor site wound on her thigh will leave an unsightly scar when wearing her bathing suit, she is reluctant to ask this question, believing that this is apparently the sacrifice she will have to make in order for her initial wound to heal.

Immediately after the skin-harvesting procedure, the operation assistant asks the surgeon which wound dressing to apply to the donor-site wound. Because convincing evidence is lacking, the surgeon suggests a hydrofibre dressing, as this is the standard local practice. The patient returns to the surgical ward with this dressing applied to the donor site. After a few days her nurse consults the wound specialist because of a dark yellow slough on the hydrofibre dressing. The wound specialist informs the patient and the nurse about the (normal) characteristics of the dressing material and the associated wound-healing process. After five days the graft has almost completely taken and the patient is discharged.

After being at home for some time, the patient consults her GP regarding the expected wound healing of the donor site and fading of the scar over time. On reviewing the discharge papers, the GP merely finds information on the
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acceptor-site wound and the split skin graft operation, but nothing about the expected outcome for the donor site.

This everyday clinical scenario exposes several issues arising from the care of such acute wounds: 1) patients with acute wounds deal with medical staff from various disciplines; 2) wound care is often based on clinical experience or preference; and 3) evidence-based guidelines or local protocols are lacking, or the available evidence is not habitually implemented in daily clinical practice. Last, but not least, patient preferences should be actively and repeatedly sought and integrated in wound care.

Thus, this scenario also demonstrates typical wound-related issues that are not in agreement with evidence-based practice, which ideally integrates patient preferences, clinical expertise and the best available evidence in clinical decision making.¹

Aim of the thesis

The overall aim of this thesis is to give an insight into the practice of evidence-based wound care. We therefore investigated:

1. Evidence generation in (acute) wound care (part I);
2. The assessment of scar formation and the patients’ appreciation of their scar formation (part II);
3. The integration of available evidence on acute wound care and clinical views and expertise in the form of a clinical interdisciplinary evidence-based guideline (part III).

Acute wound healing (part I)

Wound healing is the physiological response of the body to injury, regardless of its aetiology. The normal healing process follows four phases, namely haemostasis, inflammation, proliferation (epithelialisation) and remodelling.²,³ These phases occur in a relatively predictable fashion and should preferably result in the sustained restoration of anatomic and functional integrity.⁴-⁶ In this thesis, acute wounds are defined as wounds with an acute aetiology that undergo the healing process in a timely and orderly manner.

As was described in the clinical scenario, however, acute wounds have the potential to become complex wounds (e.g. due to wound infection). In such cases, the physiological healing cascade is disturbed and it fails to repair the tissue injury. This is defined as complex or chronic wound healing.²,⁷,⁸ This boundary between acute and complex...
wounds (formerly known as chronic wounds) overlaps in the current literature and in clinical practice, and can therefore cause confusion.\textsuperscript{9} The introduction of the term complex wound healing instead of chronic wound healing is a result of this intangible definition in wound care practice.\textsuperscript{10}

Complex wounds are a major cause of morbidity in patients and are a cost burden to hospitals and community healthcare providers, and their decision makers.\textsuperscript{2,8,11,12} Up-to-date international incidence or prevalence estimates of acute wounds are lacking.\textsuperscript{3,13,14} In the Netherlands alone, about 420,000 patients were treated in emergency rooms in the year 2012 for acute wounds resulting from accidents or self-mutilation (e.g. superficial skin injury (63%), open wounds (35%), traumatic amputation (<1%), burns, or frostbites (3%)).\textsuperscript{15}

In this thesis “wound care” is comprised of the treatment (generally provided by doctors) as well as the care for wounds (often provided by nurses or caregivers), as these two components are strongly interconnected. In order for health professionals to provide optimal wound care in daily practice, the availability of convincing evidence on wound care is highly desirable. However, niches in evidence-based wound care may occur, both in terms of the quantity of publications as well as in the level of evidence these publications offer. To appreciate the quality and quantity of the available evidence in wound care, we will compare worldwide publication trends in two distinct areas of medical expertise (Chapter 2). After identifying high-quality evidence on local and systemic wound care, we will provide clinicians with an overview of the conclusions and supply recommendations for applying this evidence in clinical decision making (Chapter 3). To improve the generation of high-quality evidence in wound care, recommendations as to the design, conducting and reporting of randomised clinical trials (RCTs) will be described in Chapter 4 and Chapter 5. As convincing evidence about which dressing material is most effective for covering acute donor-site wounds is lacking, we will try to answer this research question using a multicentre RCT called “the Rembrandt trial” (Chapter 6).

**Scar formation (part II)**

Scar formation is the last phase of normal wound healing, as was explained above. This remodelling phase can take 12 months to several years.\textsuperscript{16-18} The clinical manifestation of the remodelling phase includes contraction, decreased redness, decreased thickness, decreased induration, and increased strength.\textsuperscript{19} Scars occur after almost every skin injury, except for superficial wounds (e.g. tattoos and scratches) or in early mammalian
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Each year in the developed world, 100 million patients acquire scars as a result of 55 million elective operations and 25 million operations required after trauma. Some of these scars, however, cause considerable problems. Just as the patient in the clinical scenario wonders about the final outcome of her scar, in the perception of patients, scars can be disfiguring, aesthetically unpleasant, and may cause itching, tenderness and pain. When located in visible areas, scars have a psychological impact and could affect quality of life. Furthermore, scars can develop into dysfunctional scar contractures with severe deformities and cause a significant reduction in a patient's daily activities. The current evidence for scar treatment strategies is poor.

As a prerequisite for treating scars, accurate scar assessment is essential for the diagnosis and the initiation, monitoring and evaluation of scar treatment. The Observer Scar Assessment Scale (OSAS) is used to judge scars in vivo and on digital photographs. It is questionable whether these different methods influence the results of the scar assessment. In Chapter 7 we will assess the inter-method reliability and score agreement, and perform validity testing of in vivo and digital photographic assessments of donor-site scars.

Furthermore, we will conduct an inter-observer and patient analysis in order to investigate the agreement between caregivers and patients on the scar quality of donor-site wounds using the Patient and Observer Scar Assessment Scale (POSAS) (Chapter 8). As scar maturation evolves over time, the scar quality of patients with donor-site wounds will be compared after three and after at least six months in order to detect any relevant patient-perceived issues (Chapter 9). These issues could benefit from timely action to try and prevent further progression early in the remodelling phase.

Guideline development (part III)

Evidence on the use of prophylactic antibiotics for mammalian wounds, the treatment of donor-site wounds, and scar assessment exists and should be used in clinical decision making, as outlined in the clinical scenario above. Regardless of the quality of this available evidence, clinicians should be offered accessible and useful documents to guide them in making wound-care decisions.

Evidence-based guidelines aim to present recommendations based on the relevant evidence and clinical expertise, combined with patient preferences. In general, but also in wound care, guidelines help physicians make evidence-based decisions, taking into account not only the impact on outcome, but also the risk–benefit ratio of particular
wound materials or strategies. However, apart from the National Institute for Health and Care Excellence (NICE) guidance on the prevention and treatment of surgical-site infections (SSI), national and international evidence-based guidelines for acute wounds are lacking. The development of such a guideline is desirable because it will:

- Enhance uniformity between medical disciplines and settings;
- Improve the quality and effectiveness of wound care; and
- Help bridge the gap between desirable evidence-based use and actual use of this scientific knowledge in clinical wound practice.²⁹

In order to develop a valid and evidence-based guideline, use of the Appraisal of Guidelines and Research and Evaluation (AGREE II) criteria is recommended. We will therefore develop an evidence-based guideline, according to the AGREE II criteria, for wounds with an acute aetiology (Chapter 10). This guideline will focus on a selection of the most pressing wound-care issues as perceived by the experts in the working group.

Finally, this thesis will conclude with a discussion of the future perspectives, implementation strategies and a summary of the findings in (acute) wound care.
References


