Introduction

Hypertrophic and keloid scars are defined as benign hyperproliferative growths that occur as an abnormal response to wound healing\(^1\). As current aesthetic surgical techniques become more standardised and the results more predictable, there is a fine line between acceptable and unacceptable outcomes\(^2\). Consequently, current management of hypertrophic and keloid scars include a wide range of techniques, from traditional invasive methods to intra-lesional and topical application of agents designed to take effect on a cellular level\(^3\).

Research developments

It is evident in the literature that treatments for abnormal scarring have turned towards targeting the molecular and cellular pathways involved. Differences in wound healing and scar outcome between early foetal and adult wounds led to interest in the role of the transforming growth factor beta (TGF-β) family of cytokines in scar formation\(^4\). It is known that TGF-β isoforms 1 and 2 participate in increasing collagen synthesis, while isoform 3 is involved in scar prevention\(^5\). TGF-β3 is predominantly induced in the later stages of wound healing and has been found to reduce connective tissue deposition\(^6\). Moreover, the treatment of cutaneous rat wounds with TGF-β3 was demonstrated to reduce scarring by Shah et al in 1995\(^7\).

Extensive pre-clinical and human phase I and II clinical trial programmes investigating the use of human recombinant TGFβ3, avotermin (Juvista\(^8\), Renovo) have confirmed its scar improving efficacy, resulting in macroscopic and histological improvements in scar architecture, with improved restitution of the epidermis and an organisation of dermal extracellular matrix that more closely resembles normal skin. Avotermin has been shown to be well tolerated and is currently undergoing phase III clinical development\(^9\).

In contrast to the development of avotermin for preventing scar development, silicone gel sheets (SGS) are another treatment that have been used as a topical treatment for abnormal scars since 1983\(^10\). Despite their beneficial effect on hypertrophic and keloid scars, however, the mechanism behind their use is still unknown. The authors’ laboratory has investigated the mechanism of SGS action on hypertrophic scarring and has found that low molecular weight silicone species, applied to fibroblasts derived from hypertrophic scars, have the ability to induce apoptosis\(^11\).

Research

Clinical similarities are clearly evident between hypertrophic and keloid scars but some clinical, histological and epidemiological differences are present, suggesting that they may be distinct from one another\(^12-13\). However, most methods for treating abnormal scars are used for both hypertrophic and keloid scars. Clinical differentiation between hypertrophic and keloid scars is required before the initiation of any treatment, particularly surgical or laser-related manipulations\(^14\).

Landmark study

One of the most significant studies from the authors’ perspective was performed by Deitch et al in 1983\(^15\). This study involved investigating the factors associated with an increased risk of hypertrophic burn scar development.
The amount of time required for a burn to heal was reported to be the most important indicator of whether problems would occur. It was demonstrated that one-third of the anatomic sites became hypertrophic when burn wounds re-epithelialised between 14 and 21 days post injury; however, if the burn wound healed after 21 days then 78% of the burn sites developed hypertrophic scars\(^\text{[13]}\). While this study investigated burn scars only, it is clear that delayed epithelialisation of any acute wound dramatically increases the incidence of hypertrophic scarring.

**TOP TIPS**

The main focus for clinicians is to achieve rapid epithelialisation as a first measure of wound care to prevent abnormal scar formation. This is particularly important for wounds subjected to tension due to motion, body location or loss of tissue\(^\text{[11]}\). Adequate debridement of contaminated wounds, good haemostasis and gentle handling of tissues are also crucial factors in achieving re-epithelialisation\(^\text{[13]}\).

In terms of choosing treatments, no consensus has been reached as yet, mainly due to the limited evidence-based information found in the literature. However, most therapeutic options have potential effectiveness as both monotherapy and as combination therapy\(^\text{[14]}\).

**THE FUTURE**

The fast healing of acute wounds is clearly the key to minimising abnormal scar formation. In the future research needs to focus on further understanding the mechanism of hypertrophic and keloid scar development. Furthermore, research into the mechanism behind the action of scar treatments is also required. By understanding these aspects, clinicians and researchers will be more able to develop effective and preventative treatment options for hypertrophic and keloid scars.

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References