international wound journal

International Wound Journal ISSN 1742-4801

LETTER TO THE EDITOR

Unwanted hair growth induced by topical epidermal growth factor during wound healing: true or myth?

Dear Editors,

Epidermal growth factor (EGF) and the EGF receptor (EGFR) play an essential role in wound healing through the stimulation of epidermal and dermal regeneration (1). EGF induces dermal wound healing through stimulation, proliferation and migration of keratinocytes, endothelial cells and fibroblasts (2). Thus, topical administration of EGF has been used in various skin defects, such as skin grafts, venous ulcers and diabetic foot ulcers.

A 29-year-old woman presented with a linear abrasion of $1 \times 10\,cm^2$ area resulting from a fall on stairs (Figure 1). Primary closure was not considered because the width and the depth of the wound were not suitable for suturing and the margin was irregular. We decided to treat the wound with topical EGF to repair the skin defect. During treatment, 0·2 ml (100 mg) recombinant human EGF (50 mg/100 ml corresponding to 60 000 000 IU; Daewoong Pharmaceutical, Seoul, South Korea) was topically applied twice a day with hydrocolloid dressing (Duoderm CGF®; ConvaTec, Woerden, the Netherlands) for 2 weeks. The wound had completely healed after 2 weeks, with only a linear scar remaining. In addition to wound healing, new hair growth was observed on the normal skin around the wound (Figure 2). There was no visible hair before the treatment, and the patient had not been treated previously with any depilation procedure on her legs. We surmised that growth of the new hair was induced by topical EGF, because there was no newly grown hair at any other site on the body, except for the periwound lesion where topical EGF was applied. In addition, the patient had never before experienced new growth of hair at the sites of previously healed wounds.

That wound healing process can induce new hair growth is a natural concept, and there are few related papers in literature. Ito *et al.* (3) reported that skin wounds can stimulate spontaneous formation of hair as a part of the normal healing process and Sun *et al.* (4) also reported a case of new hair growth around healing wounds. After the skin has been wounded, various signalling systems coordinate the healing process. It remains unclear which mechanisms and precise signalling pathways affect hair growth during healing, but a great deal of research has implicated several cell signalling pathways, including the Wnt, Bmp, sonic hedgehog, Notch, fibroblast growth factor and transforming growth factor-β pathways, in the tug of war of differentiation into epidermal cells and hair follicle cells (3,5). Although interpretations of signal pathways exist, the remaining question is that hair growth is not always present with wound healing. For this reason, it is believed that the regeneration of new hair follicles requires a specific chemical and physical microenvironment.

The present case suggests that EGF may play a key role in this phenomenon. In addition to increasing reepithelialisation, EGF can act as the cyclical on/off switch of the hair cycle (6). Mak and Chan suggested that the constitutive expression of EGF inhibits entry into the catagen phase, and, based on their study using a mouse model, EGF receptor/ErbB2 signalling appears to be essential for hair growth (7). Furthermore, in vitro studies with isolated human hair follicles have shown that EGF stimulates DNA synthesis in the outer root sheath as well as hair follicle elongation (8). On the basis of these studies and our case, EGF may be the trigger of new hair growth, and further studies on the relationship between EGF and hair growth are needed to solve this puzzle.

In conclusion, clinicians should be aware that new hair growth could be induced by topical EGF in wound dressing, and have to explain the possibility when they apply topical EGF.

Figure 1 Abrasion wound before treatment; 1 cm × 10 cm size linear abrasion wound with irregular depth and margins on the right pretibial area. There is no visible hair around the wound.

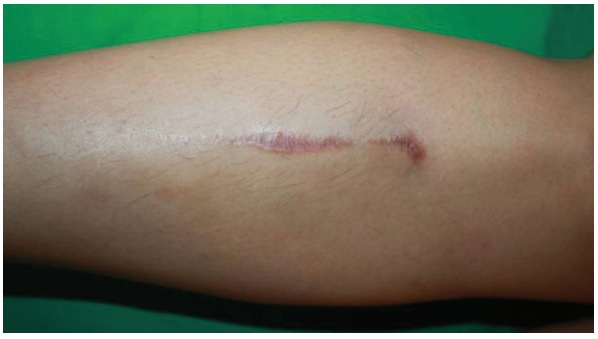

Figure 2 Wound after 2 weeks of treatment. The wound healed, forming scar tissue, and newly grown hair can be observed in the periwound region.

 doi: 10.1111/iwj.12354

Moo Yeol Hyun[1], Jang Mi Suk[2], Kwang Ho Yoo[1], Beom Joon Kim[1], Myeung Nam Kim[1] & Chang Kwun Hong[1]
[1]Department of Dermatology
Chung-Ang University College of Medicine
Seoul, South Korea
beomjoon74@gmail.com
[2]Department of Dermatology
P&K Skin Research Center
Seoul, South Korea

References

1. Bodnar RJ. Epidermal growth factor and epidermal growth factor receptor: the Yin and Yang in the treatment of cutaneous wounds and cancer. *Adv Wound Care (New Rochelle)* 2013;**2**:24–9.
2. Wenczak BA, Lynch JB, Nanney LB. Epidermal growth factor receptor distribution in burn wounds. Implications for growth factor-mediated repair. *J Am Acad Dermatol* 2012;**67**:491–3.
3. Ito M, Yang Z, Andl T, Cui C, Kim N, Millar SE, Cotsarelis G. Wnt-dependent de novo hair follicle regeneration in adult mouse skin after wounding. *Nature* 2007;**447**:316–20.
4. Sun ZY, Diao JS, Guo SZ, Yin GQ. A very rare complication: new hair growth around healing wounds. *J Int Med Res* 2009;**37**:583–6.
5. Fuchs E, Raghavan S. Getting under the skin of epidermal morphogenesis. *Nat Rev Genet* 2002;**3**:199–209.
6. Alexandrescu DT, Kauffman CL, Dasanu CA. The cutaneous epidermal growth factor network: can it be translated clinically to stimulate hair growth? *Dermatol Online J* 2009;**15**:1.
7. Mak KK, Chan SY. Epidermal growth factor as a biologic switch in hair growth cycle. *J Biol Chem* 2003;**278**:26120–6.
8. Philpott MP, Kealey T. Cyclical changes in rat vibrissa follicles maintained In vitro. *J Invest Dermatol* 2000;**115**:1152–5.